Cost Growth of Major Defense Programs

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30 January, 2003

Agenda

- Background

- Methodology

- Results

- Website

CG History

- Ongoing for ten years
  - OSD: Dave McNicol, Gary Bliss, Jerry Pannullo, Mark Daley, and John McCrillis
  - NAVSHIPSO Philadelphia: Bob Ellwood and Chuck Buchinski
  - AT&T: JoOn Yang
- Various presentations to date

So Why Now?

- **More systems**
  - 142 MS II
- **Converted MS Excel to MS Access**
  - Transportable to other databases
  - Avoids calculation errors inherent with Excel
    - Charting remains in Excel
- **Added PNO, Subcategory's, and Schedule**
- **Website**

What is CG?

- Difference between today's estimate and a baseline estimate caused by:
  - Poor initial estimate
    - Ill defined program
  - Different program than originally conceived
    - Different procurement quantities
    - Requirement changes
  - Inefficiencies
    - Too many people
    - Too much money
    - Lack of focus
  - Other

Why Do The Study?

- Is there a problem?
  - If so, where is it?
- What are the primary growth areas?
  - Is there an initiative that can be taken to correct the problem?
- Is there an estimation problem?
- How much of a technical problem is there?
- Can I use the past to predict the future?

DoD vs. the World

COST GROWTH IN MAJOR PROJECTS (TASC)†
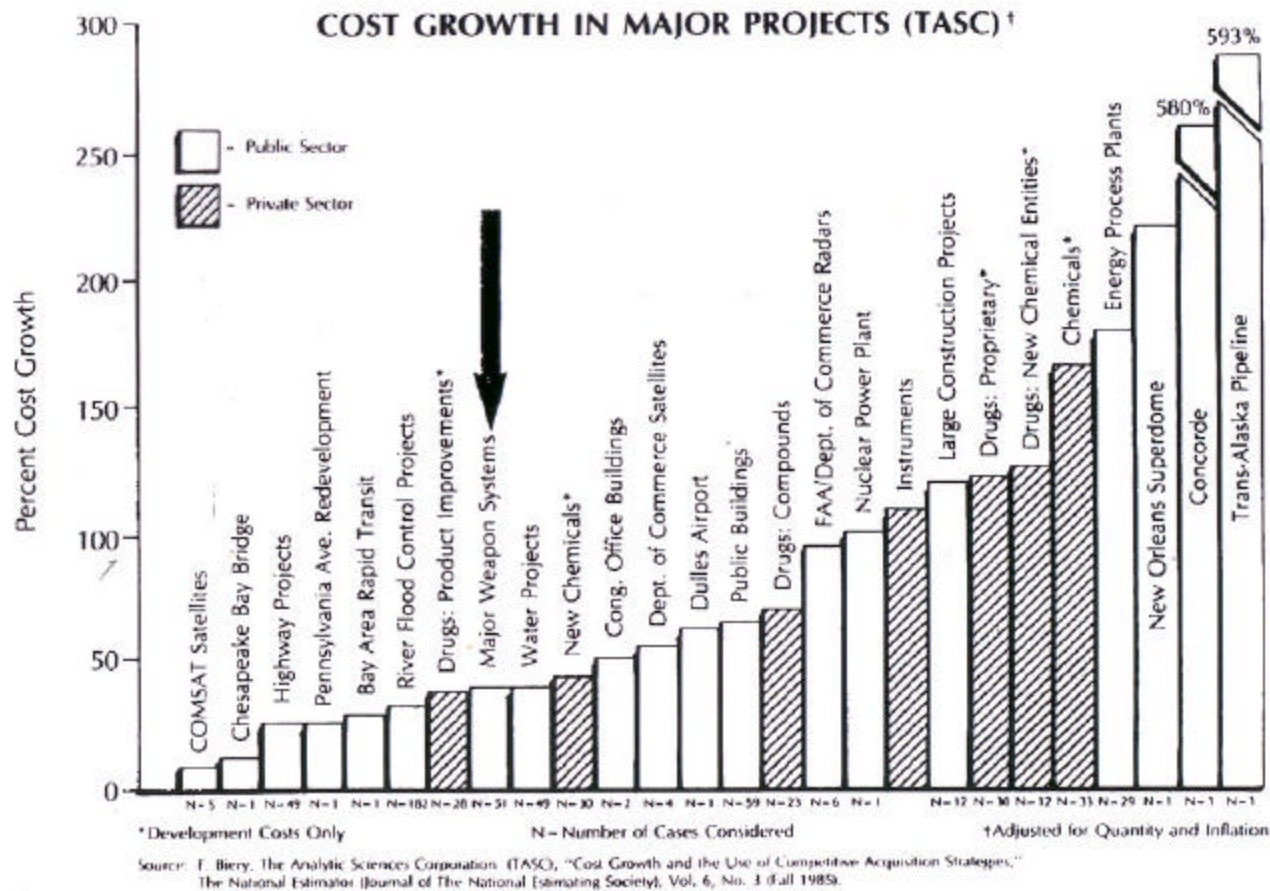
CG Definition

- Current estimate/baseline estimate
- For our study
  - Baseline est = total program cost adjusted for inflation at a fixed point in time
  - Current est = total program cost adjusted for inflation and quantity variation

Study Objective

- Identify how much of cost growth is attributable to:
    - Decisions = Discretionary changes to the system relative to the description at Milestone 2
    - Mistakes = Changes not attributable to discretionary changes post Milestone 2

- Establish a historical record for comparison

Data Source

- **SARs (Selected Acquisition Reports)**
  - Contains
    - Descriptions
    - Schedule
    - Official DoD cost estimate
      - RDT&E, Procurement and MilCon
      - No O&M
    - Actuals to date
    - Procurement numbers
    - Incremental changes from previous SAR estimate
      - Variances
  - Prepared annually or quarterly if significant changes

Major Defense Acquisition Programs (MDAPs)

- Eventual RDT&E total > $365 CY00 or

- Eventual Procurement total > $2.19B CY00 or

- Designated by Secretary

- Either Acquisition Category (ACAT) 1D or 1C

Scope

- 286 programs submitted SARs since 1969
- 187 entered into database
- 142 met study criteria
  - Unclassified
  - Milestone 2 captured
  - Three years of data past milestone 2
  - Data complete

System Count

Service	A	F	N	J	Total
Aircraft	6	20	15	1	42
C4ISR	12	5	7		24
Ground	14				14
Missile	10	9	11	4	34
Ship			19		19
Space		8	1		9
Total	42	42	53	5	142

Systems Names (1)

Aircraft		C4ISR
A-10 Thunderbolt	F-16 Falcon	ADDS EPLRS (Enhanced Pst Location Rpt Sys)
A-6E/F Intruder	F-22 ATF	AEGIS MK-7
AH-64 Apache	F-5E Tiger	AFATDS (Adv Field Artilleray Tact Data Sys)
AH-64D Apache Airframe	JTUAV Short Range Hunter	ALQ-165 ASPJ (Jammer)
AH-64D Apache FCR	KC-135R Stratotanker	ALQ-212(V) ATIRCM/CMWS
AV-8B Harrier	LANTIRN (Low Alt Nav & Targeting Sys)	ARC-210 SINCGARS Radio
AV-8B Harrier Remanufacture	LGM-30 Minuteman III GRP	ATCCS ASAS Blk II/III
B-1B Lancer	LGM-30 Minuteman III PRP	ATCCS CSSCS
C-130J Hercules	MH-60R Strikehawk	ATCCS FAAD C2I
C-17A Globemaster	RPV Aquila	CEC (Coop Engagment Capability)
C-5B Galaxy	SH-60B LAMPS Mk III	E-3 Sentry AWACS RSIP
CH-47 Chinook	SH-60F CV Helo	FPS-118 OTH-B (Over Horizon Backscatter Radar)
CH-53 Super Stallion & MH-53 Sea Dragon	T-45 Goshawk Training System	JSTARS GSM
CSRL (Rotary Launcher)	T-46A Eaglet Trainer	JSTARS USAF
E-2C Hawkeye AEW	T-6A JPATS (Jt Prmy AC Training Sys)	JTIDS (Tact Info Dist Sys)
E-3A Sentry AWACS	TRN-45 MMLS Ground Components	JTIDS DTDMA USN
E-4 AABNCP NEACP	UH-60A Blackhawk	MIDS LVT (Low Vol Terminal)
E-6A TACAMO	V-22 Osprey USN	MSE (Mobile Subscriber Equipment)
EA-6B Prowler ICAP		NAS (National Airspace System)
EF-111A TJS		SMART-T (Secure Mobile Terminal)
F/A-18 E/F Super Hornet		SQR-19 TACTAS
F/A-18 Hornet		SYQ-23 JSIPS (Jt Ser Imagery Proc Sys)
F-14D Tomcat		TTC-39 Nodal Comm Switch
F-15 Eagle		USQ-84(V) SOTAS (Target Acquistion Sys)

Systems Names (2)

Missile		Ground Combat
AGM-114 Hellfire	Navy Area TBMD	ATACMS Blk I (APAM)
AGM-114K Hellfire Longbow	RGM-109 Tomahawk BIP (Baseline Imp Prgm)	ATACMS Blk II/IIA
AGM-131A SRAM II (Short Range Msl)	RGM-109 Tomahawk MMM (Multi Mission Msl)	Crusader Field Artillery Sys
AGM-65D Maverick IR	RIM-67 Standard Missile II	DIVAD (SGT York)
AGM-84A Harpoon	SADARM 155mm Projectile	FAADS LOS-F-H ADATS
AGM-86B ALCM	SADARM Rocket	FAADS LOS-R Avenger
AGM-88 HARM USAF		FMTV (Family Med Tact Vehicles)
AGM-88 HARM USN	**Ship**	M1 Abrams Tank
AIM-120 AMRAAM	CG 47 Aegis Cruiser	M198 155MM Howitzer
AIM-54C Phoenix Missile	CVN-71 Roosevelt	M1A2 Abrams Tank Upgrade
AIM-7M Sparrow (USAF)	CVN-72/73 Lincoln & Washington	M2/M3 Bradley FVS
AIM-7M Sparrow (USN)	CVN-74/75 Stennis & Truman	M2/M3 Bradley FVS Upgrade
AIM-9L Sidewinder	CVN-76 Reagan	M26 MLRS (Mult Launch Rocket Sys)
AIM-9L Sidewinder (USN)	CVN-77	PLS FHTV (Palletized Load System)
AIM-9M Sidewinder	DDG-51 Burke	
AIM-9X Sidewinder	FFG-7	**Space**
ATACMS P3I (BAT)	LCAC (Landing Craft Air Cushion)	DSCS-III (Def Sat Comm Sys)
BGM-109G Tomahawk GLCM	LHD 1 Amphibious Assault Ship	GBS (Global Broadcast Service)
BLU-108 JSOW AIWS	LPD 17 Amphibious Transport Dock Ship	GPS NAVSTAR
BLU-108 JSOW Unitary	LSD 41 Whidbey Island	IUS (Inertial Upper Stage)
CBU-97B SFW (Sensor Fuzed Weapon)	LSD 41 Whidbey Island Cargo Variant	LGM-118A Peacekeeper
FGM-148A Javeline AAWS-M	NATO PHM Pegasus Class	LGM-118A Peacekeeper Rail Garrison
FIM-92 Stinger Missile	SSN 688 Los Angeles	SBIRS (Space Based IR Sensor) High
JDAM (Jt Direct Attack Munition)	SSN 774 Virginia Class New Attack Sub	Titan IV ELV (Expend Launch Veh)
M47 Dragon Guided Missile	T-AKR 295 Strategic Sealift	UGM-133A Trident II Missile
M712 CLGP (Cannon Launched) Copperhead	T-AO 187 Oiler	
MIM-104 Patriot Guided Missile System	Trident II Submarine	
MIM-104 Patriot PAC-3 (Pat Adv Capablity)		

System Categories

- Difficult to identify
- Procurement usually dominates expenditures
  - Categorized based on majority of dollars
  - Not always consistent
    - Some development $ had little to do with procurement $
    - Refinements, redistricting possible
  - Need statistically representative number of systems in each

- What will Future Combat System (FCS) be?

SAR Limitations

- Changes in SAR preparation guidelines
- Errors in math or facts
- Cost sharing in joint programs may be reported in multiple SARs if at all
- Variance categories not always consistent
- Accuracy of programs total cost estimate
- Rebaselining

- Is there something better?

Methodology

- Data collected by NAVSHIPSO and stored in db
  - RDT&E, Proc, & MilCon total estimates by year
    - Only using RDT&E and Proc, too many issues with MilCon
  - Incremental variance data
    - Categorize as a mistakes or decision
    - Verify variances total yearly difference in total estimate
    - Identify as quantity related variance
  - Quantity data
  - Actual procurement $ and quantities to date
  - Schedule data
  - Miscellaneous data like notes and bookkeeping

Mistake Subcategories

- MCEP: Cost estimating production changes
- MCEDE: Cost estimating development engineering
- MILS: ILS spares and support changes
- MSSMF: Schedule changes, and acquisition strategy changes, and management initiatives
- MOTHER: Other discretionary changes

Decision Subcategories

- DRCV: Requirements, configuration, and variant changes
- DSMMI: Schedule, multiyear, and management initiatives
- DILS: ILS changes and spares and support
- DEPF: External program factors (Congress, FMS)
- DOTHER: Other changes not attributable to discretionary changes

Variance Examples

- Mistakes
  - Estimate (MCEP): Increase in flyaway cost due to underestimation of manufacturing hours
  - Engineering (MCEDE): Additional costs for EMD targets, lethality, and OT&E
  - Support (MILS): Underestimation of initial spares
  - Schedule (MSSMF): Delay in start of production
- Decisions
  - Requirements (DRCV): Costs associated with incorporating next generation missile series improvements
  - Schedule (DSMMI): Across-the-board budget cut forces slower production rate
  - Support (DILS): Revised requirements for training devices and spares

Calculations Overview

- Convert all cost data to base year 2000
  - RDT&E, Proc, and MilCon averages for all services
- Normalize current cost estimate to the baseline quantity
  - Apply a learning curve to all variances that are quantity related
  - Ignore all non-quantity related variances
- Add adjusted variances to generate a normalized current estimate

- Results are cost growth factors as of the latest SAR, not time phased

Learning Curve

Calculate yearly unit cost from actual $ proc/# units

Learning_slope = 2^m where:

 m = [Duration*sum(x(FY)*y(FY))-sum(x(FY))*sum(y(FY))]/
     [Duration*sum(x(FY)^2)-(sum(x(FY)))^2]

   Sums are from base to current year
   Duration = Current_year - Base_year
   X(FY) = log(total_#_units_to_date)
   Y(FY) = log(unit_cost_to_date)

Slope Adjustments

- Adjust slope if > 1 or < 0.6
  - A nominal value is .85
  - Program may not have procured anything
  - If the unit cost grows with time (> 1), using a value < 1 like 0.9 will result in more cost growth

Quantity Normalization

- Is the variance quantity related?
- If it is quantity related, is the variance applicable to all quantities?
- If both are true, apply the following correction:

- $\text{Adjusted\_Var} = \text{Var} * [(Q_0 + Q_{rdte})^{\wedge}(b+1) - qty^{\wedge}(b+1)] /$
- $\qquad\qquad [(Q_c + Q_{rdte})^{\wedge}(b+1) - Q_{rdte}^{\wedge}(b+1)]$
  - where
    - Q_0 = Procurement quantity total for the baseline year
    - Q_{rdte} = RDT&E quantity
    - Q_c = Procurement quantity total current year
    - $b = \log(m)/\log(2) + 1$
    - m = learning curve slope

Baseline Year

- Use MS 2 estimate as baseline
  - Difficult to identify if not explicit
  - Contract dates or other knowledge
    - Development contract award date
  - Judgment necessary
- Cost growth can be very sensitive to base year
  - Changing base year can have dramatic changes on some programs
  - Stable programs don't show much sensitivity

Milestone Definitions

- 1 = proceed with demonstration and validation
- 2 = proceed with engineering, manufacturing, and development (EMD)
- 3 = proceed with production
- A = proceed with concept and technology development
- B = 2
- C = proceed with production and development

- Contract award dates replace MS review date if not identified
- Future will include MS 1 & 3

Outputs

- CG is a function of
  - Service(A,F,N,J)
  - Commodity(Aircraft, C4ISR, Ground, Missile, Ship, Space)
    - Aircraft(Large(5), Helicopter(9), UAV(2), System(6), Trainer(3), Electronic(6), Tactical(11))
    - C4ISR(Sensor(10), Command & Control(8), Communication(6))
    - Ground Combat(Ordnance Delivery Sys(7), Tank,(5) Transport(2))
    - Missile(ATA(8), Cruise(4), ATG(7), Projectile(4), STS(5), STA(4), Man Portable(2))
    - Ship(Carrier(6), Combatant(3), Submarine(3), Support(7))
    - Space(Ballistic(3), Rocket(2), Satellite(4))
  - Funding(RDT&E & Proc)
  - Variance category(Mistake(5), Decision(5))
  - Calendar Year
  - Milestone
- Arithmetic and dollar weighted averages

Methodology Conclusions

- Production rate changes may be considered in future studies
  - Not explicitly captured in current calculations

Program Size by FY

142 Systems

MS II Eatimate (Constant FY00$ Billion)

80
70 — ◆ F-22
60 — ◆ F/A-18 E/F
50 — ◆ SSN 774
40 — Trident II
30 — B-1B ◆ C-17 ◆ V-22
20 — F-15 F/A-18
10
0

Fiscal Year of Milestone II

1969   1974   1979   1984   1989   1994   1999
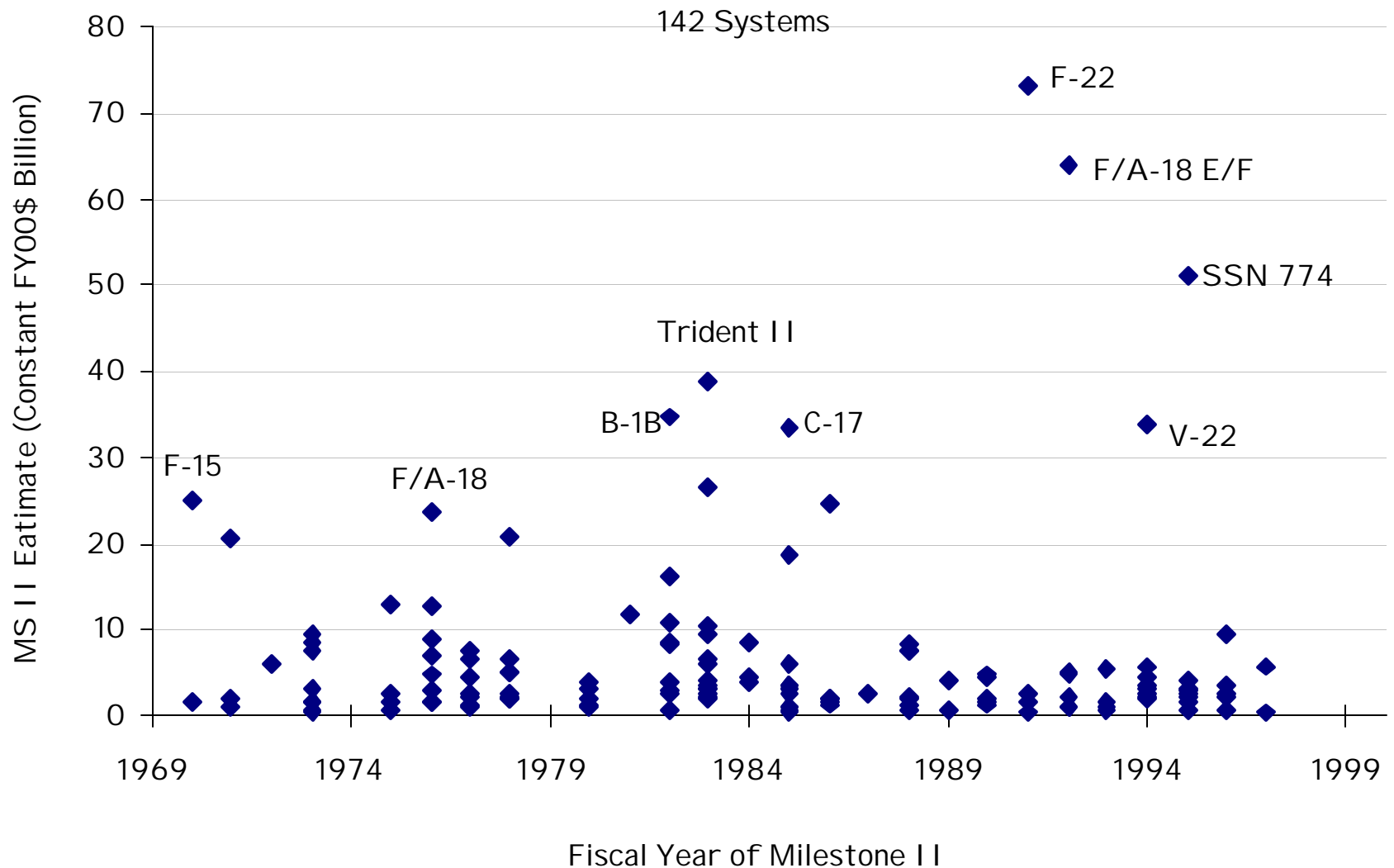
Division of Resources

18%

82%

RDT&E

Procurement
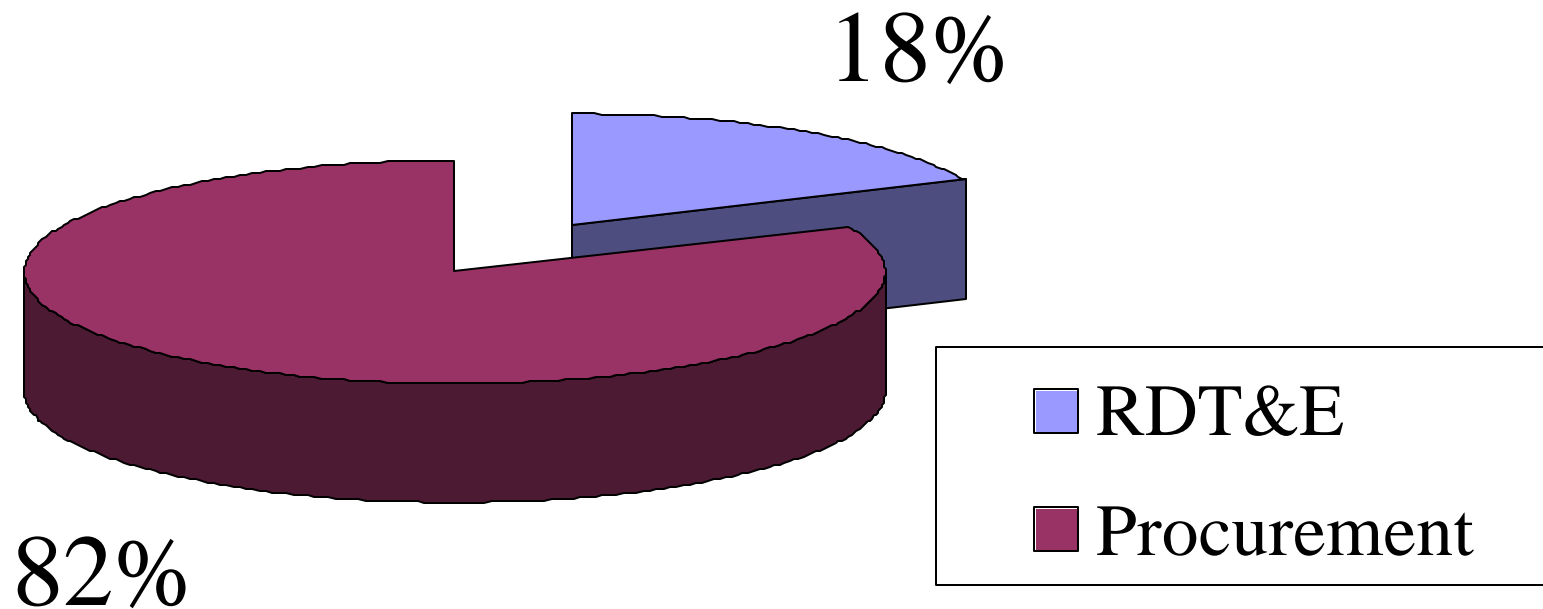
Statistics

	RDT&E	Proc	Total
Minimum	-64%	-54%	-51%
Maximum	471%	327%	315%
Average	45%	29%	32%
Median	27%	13%	18%
Standard Deviation	71%	50%	50%
Dollar Weighted Average	17%	11%	12%
Number Systems	137	138	142

Total CG by Program Size

Do the services budget to cost for large systems and cost to budget for smaller ones?

142 Systems

Percent Cost Growth vs Milestone II Estimate (Constant FY00$ Billion)

Labeled points: JTIDS, TITAN IV-CELV, SADRAM, F/A-18, C-17, B-1B, SSN 774, F/A-18E/F, F-22, V-22, Trident II Missile
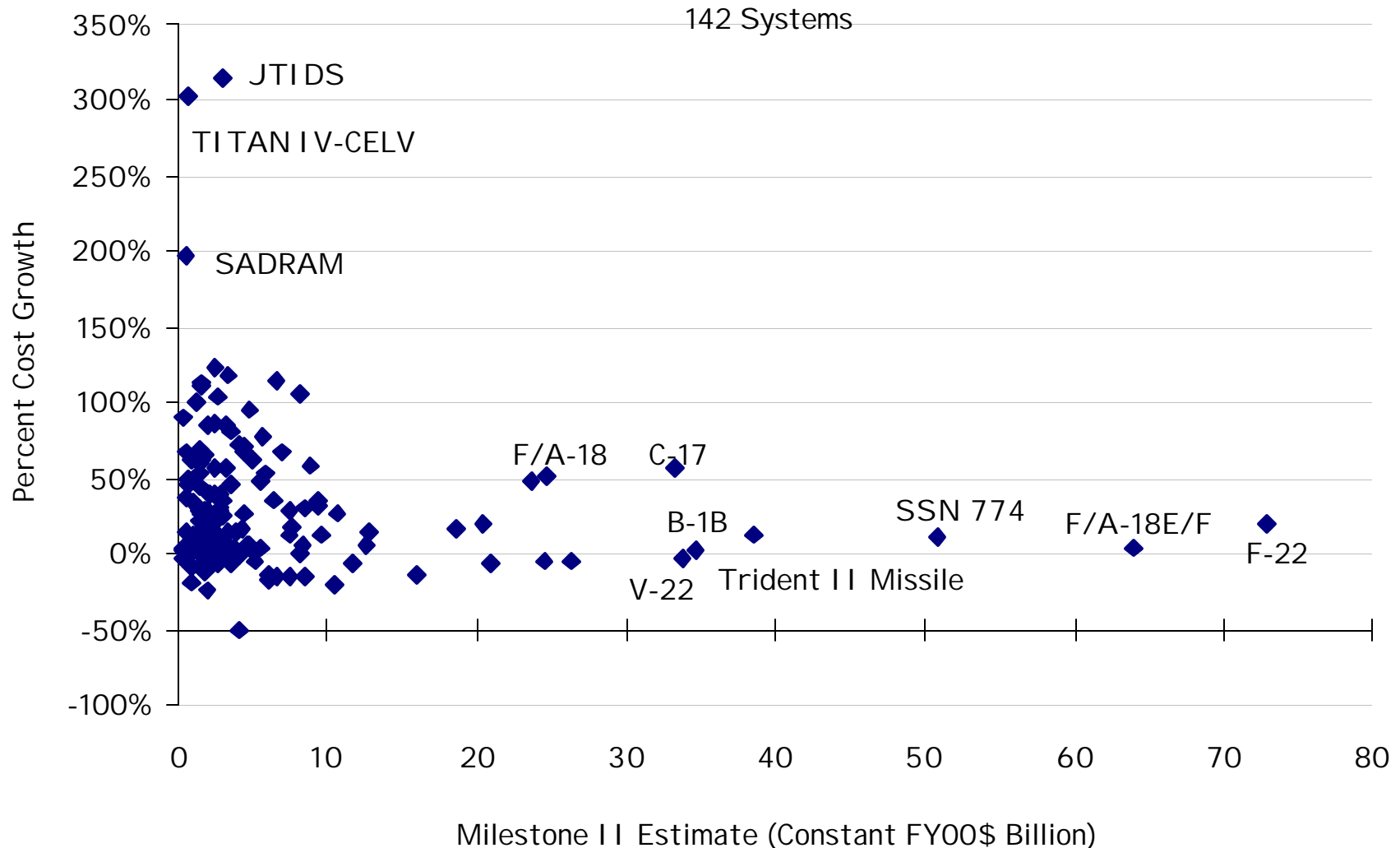
Total CG by Fiscal Year

Are we getting any better?

142 Systems

TITAN IV CELV   JTIDS

SADARM

Copperhead

Stinger   Bradley   JSTARS   FMTV

Percent Cost Growth

Fiscal Year of Milestone II
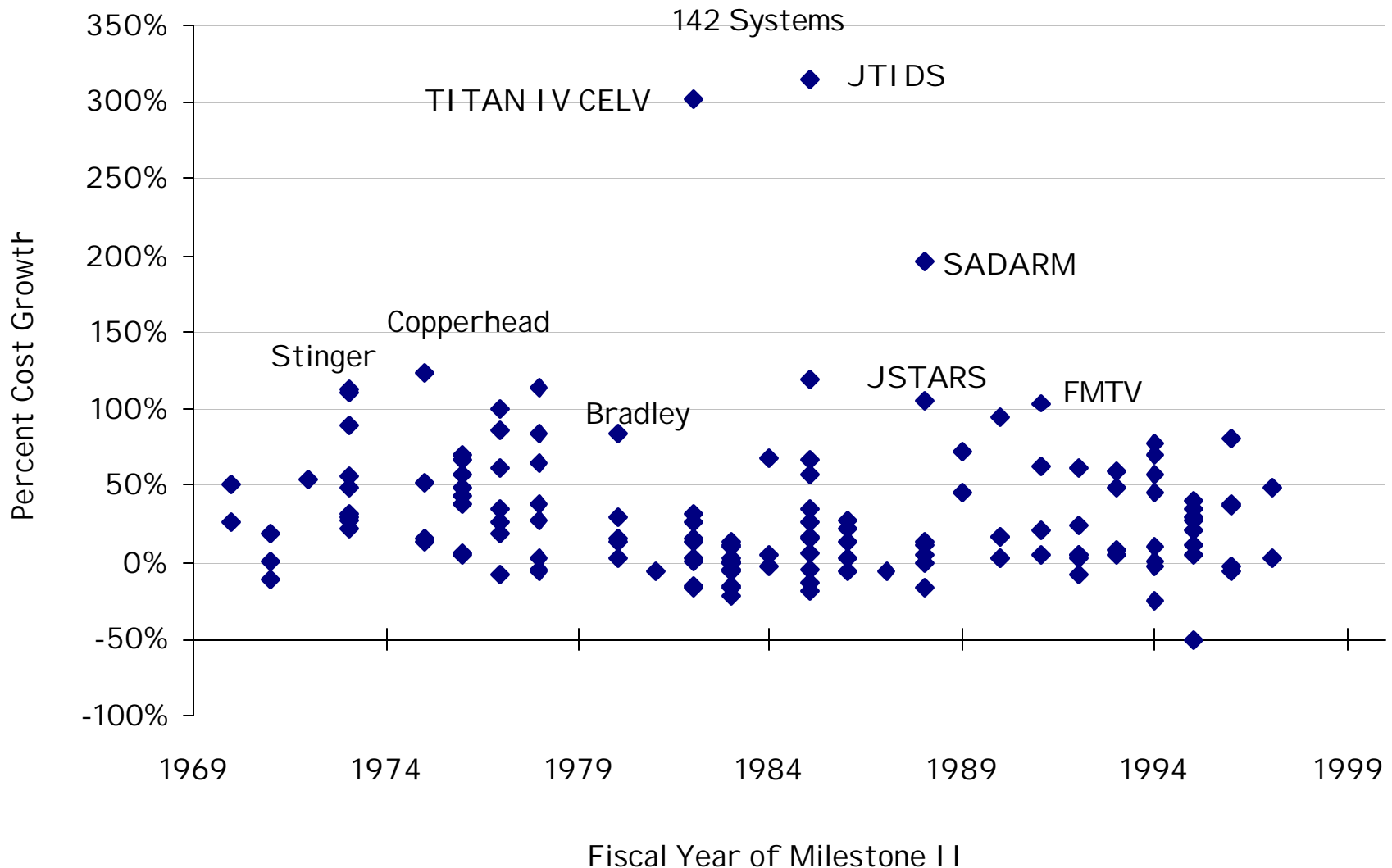
Total CG Distribution

142 Systems
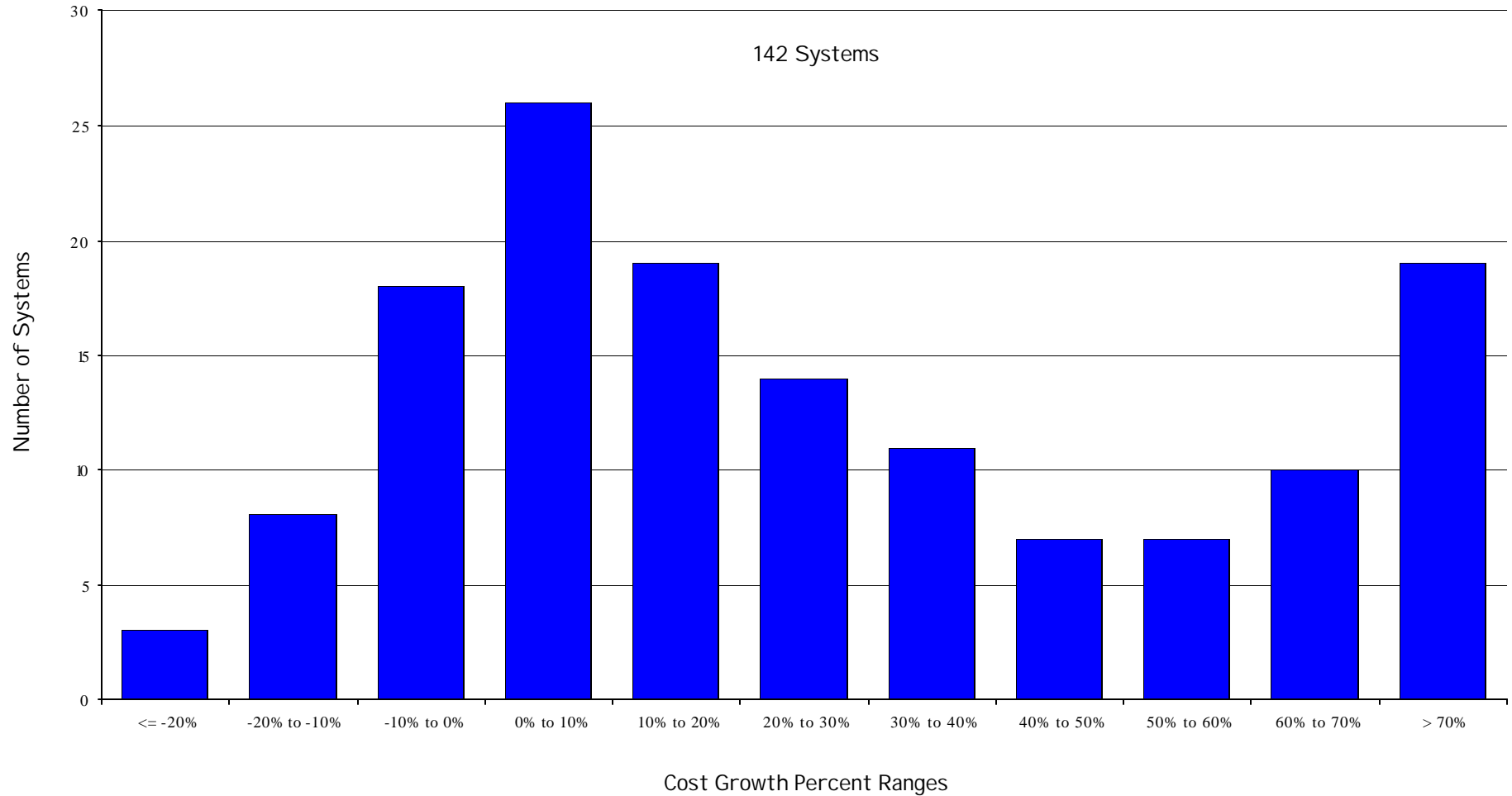
Total CG by Commodity
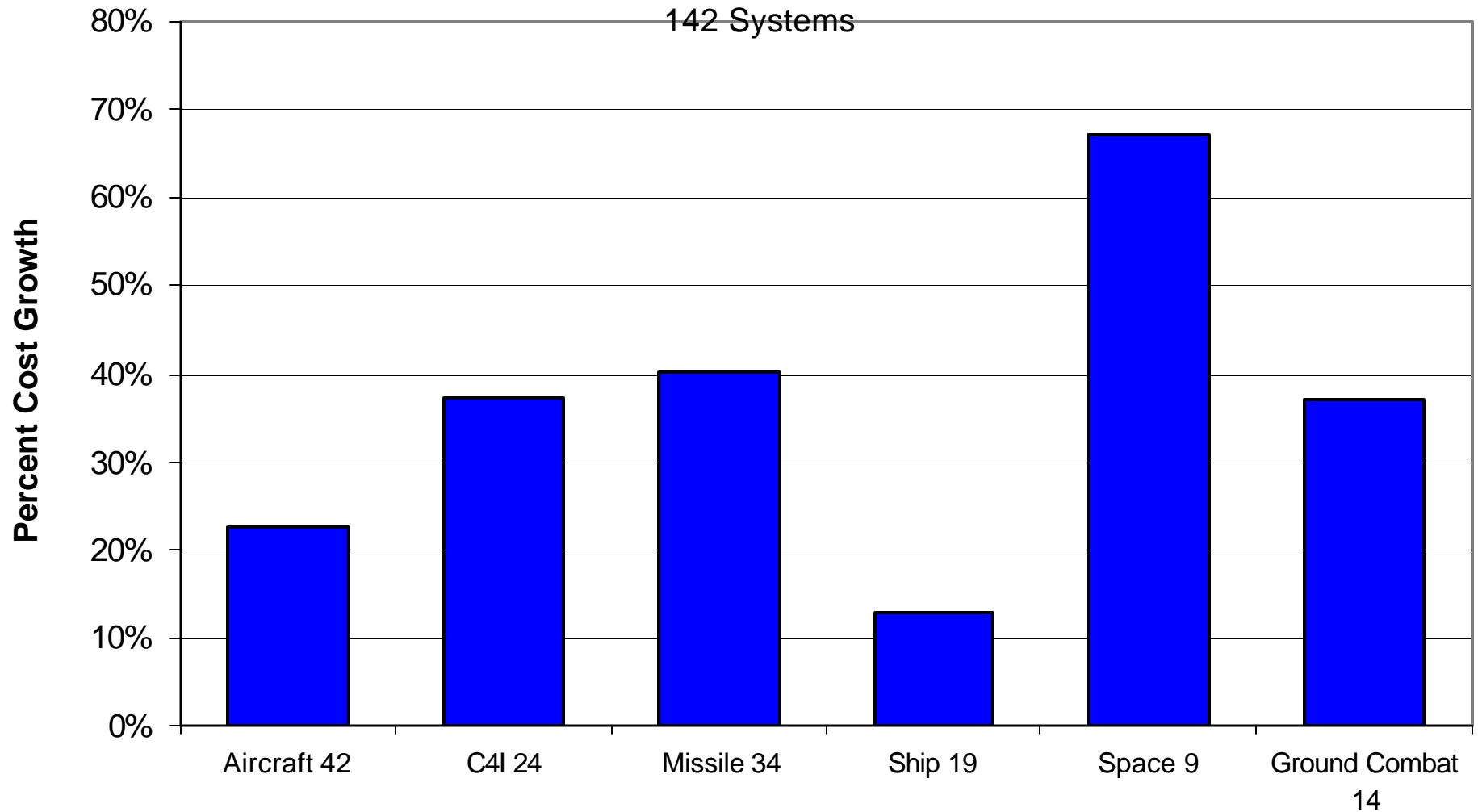
RDT&E CG by Commodity
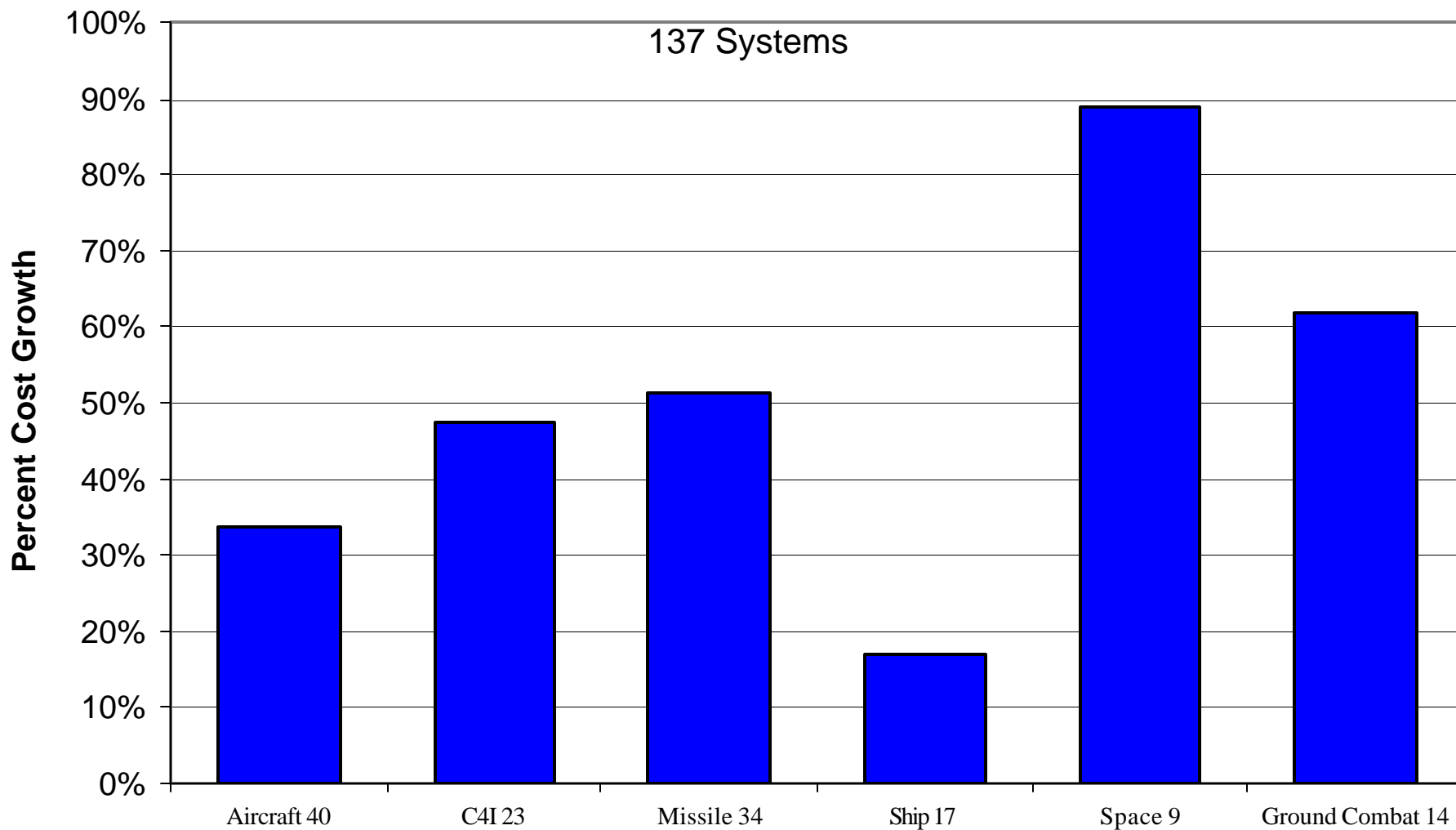
Procurement CG by Commodity
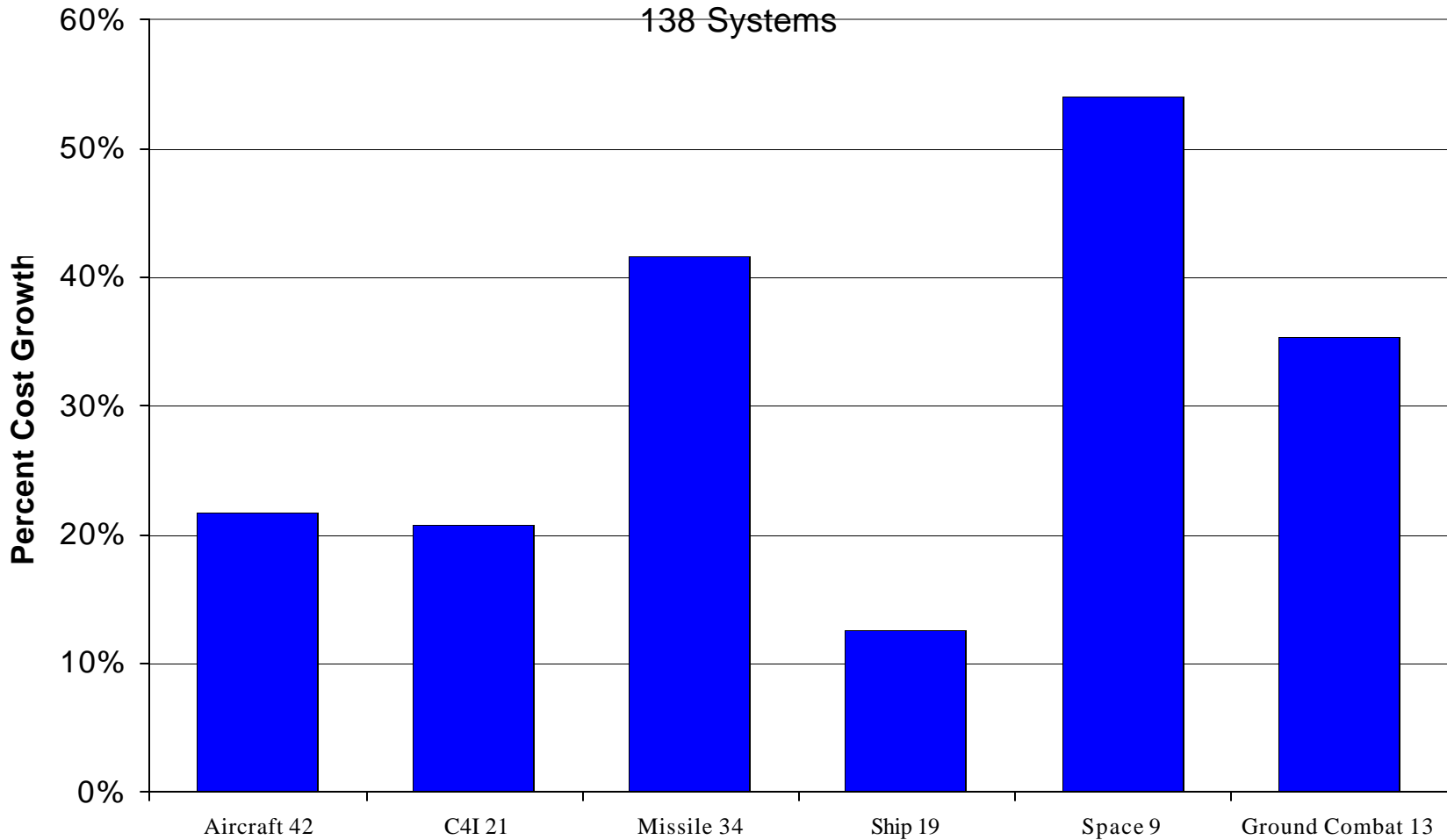
Total CG by Subcommodity

Total CG by Service

Chart titled "Total CG by Service" showing Percent Cost Growth by service category. Legend: Army, Navy, Air Force, Joint. Label "142 Systems". Categories along x-axis: Aircraft, C4I, Missile, Ship, Space, Ground Combat. Y-axis ranges from -20% to 100%.
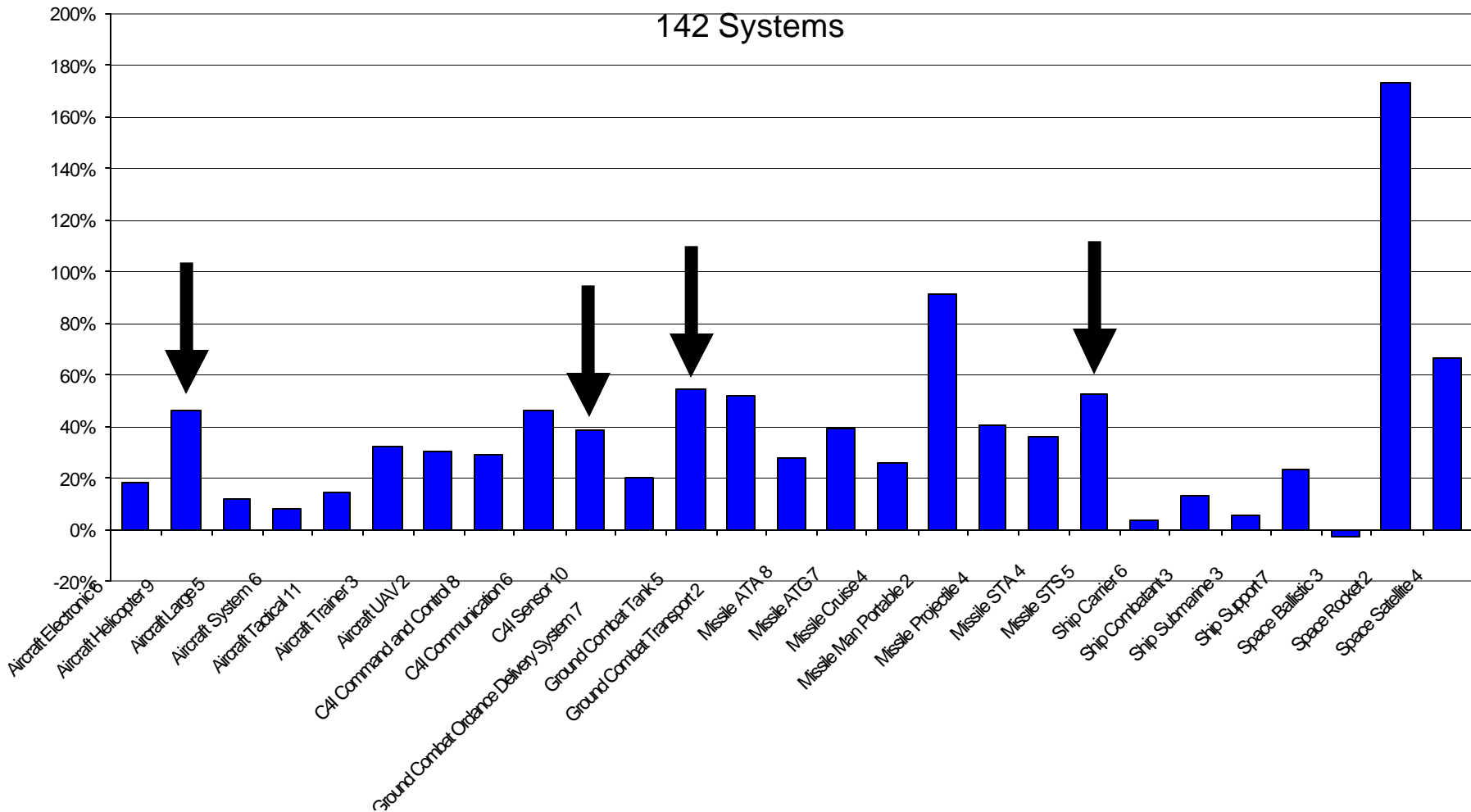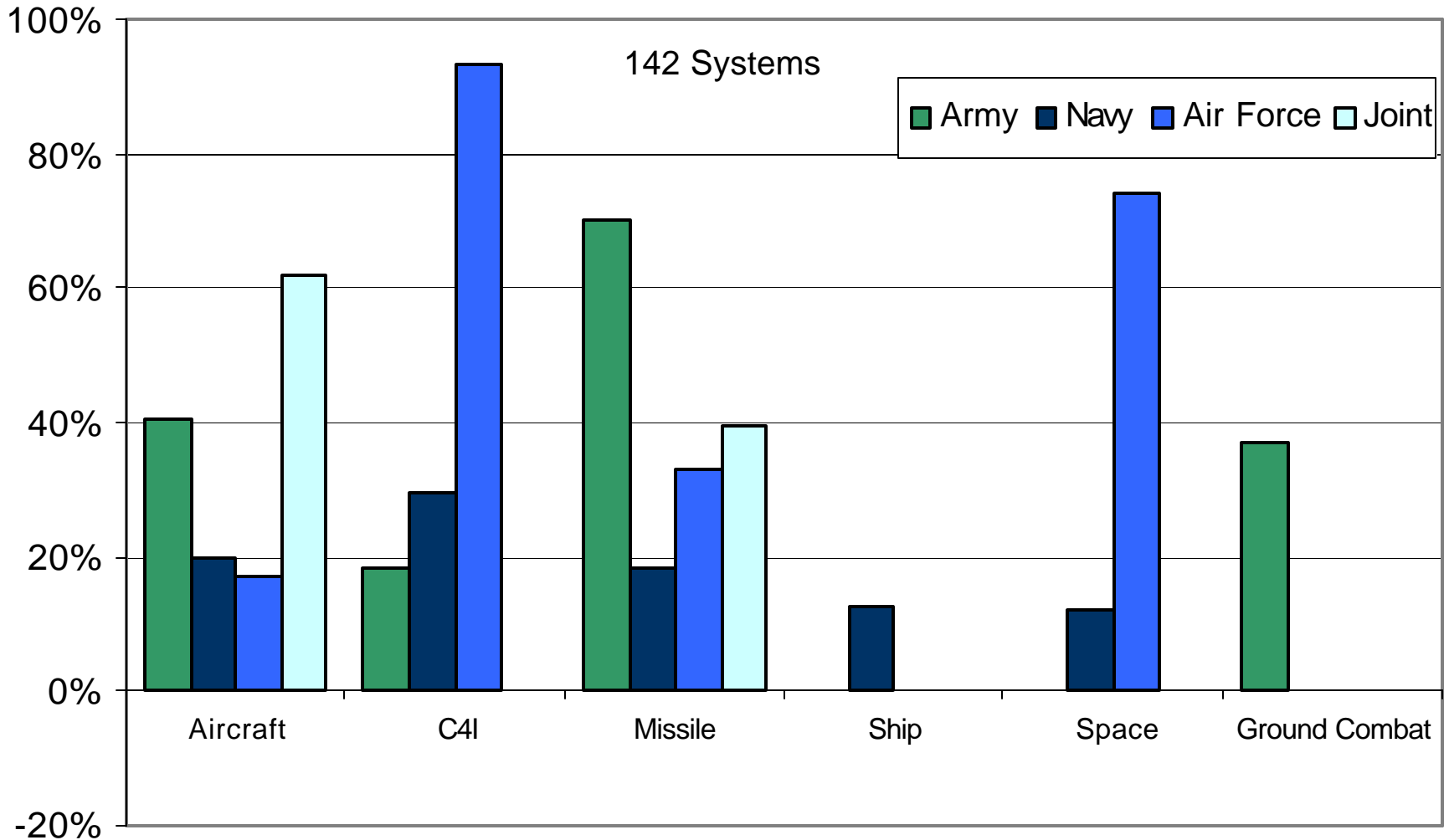
Total CG by Mistakes and Decisions

Nearly half of perceived growth is content change

Total CG Mistakes

142 Systems

Legend:
- Other Mistakes (green)
- ILS Factors; Spares & Support (light green)
- Schedule Slips/Management Factors (red)
- Engineering/Test/Development (yellow)
- Production Assumptions & Estimation (blue)

Y-axis: Percent Cost Growth, ranging from -5% to 25%

Total CG Decisions

Percent Cost Growth

142 Systems

Legend:
- Other Decisions
- External Prog. Factors (FMS, strikes, etc.)
- ILS Factors; Spares & Support
- Schedule/Multiyear/Mgmt Initiatives
- Requirements/Configuration/Variants

Y-axis: -2%, 0%, 2%, 4%, 6%, 8%, 10%, 12%, 14%

RDT&E Mistakes & Decisions

RDT&E Decision

Requirements are the driver

131 Systems

Legend:
- **Other Decisions** (green)
- **ILS Factors; Spares & Support** (light green)
- **External Prog. Factors (FMS, strikes, etc.)** (red)
- **Schedule/Multiyear/Mgmt Initiatives** (yellow)
- **Requirements/Configuration/Variants** (blue)

Y-axis: **Percent Cost Growth** (−5% to 30%)

% of RDT&E Total
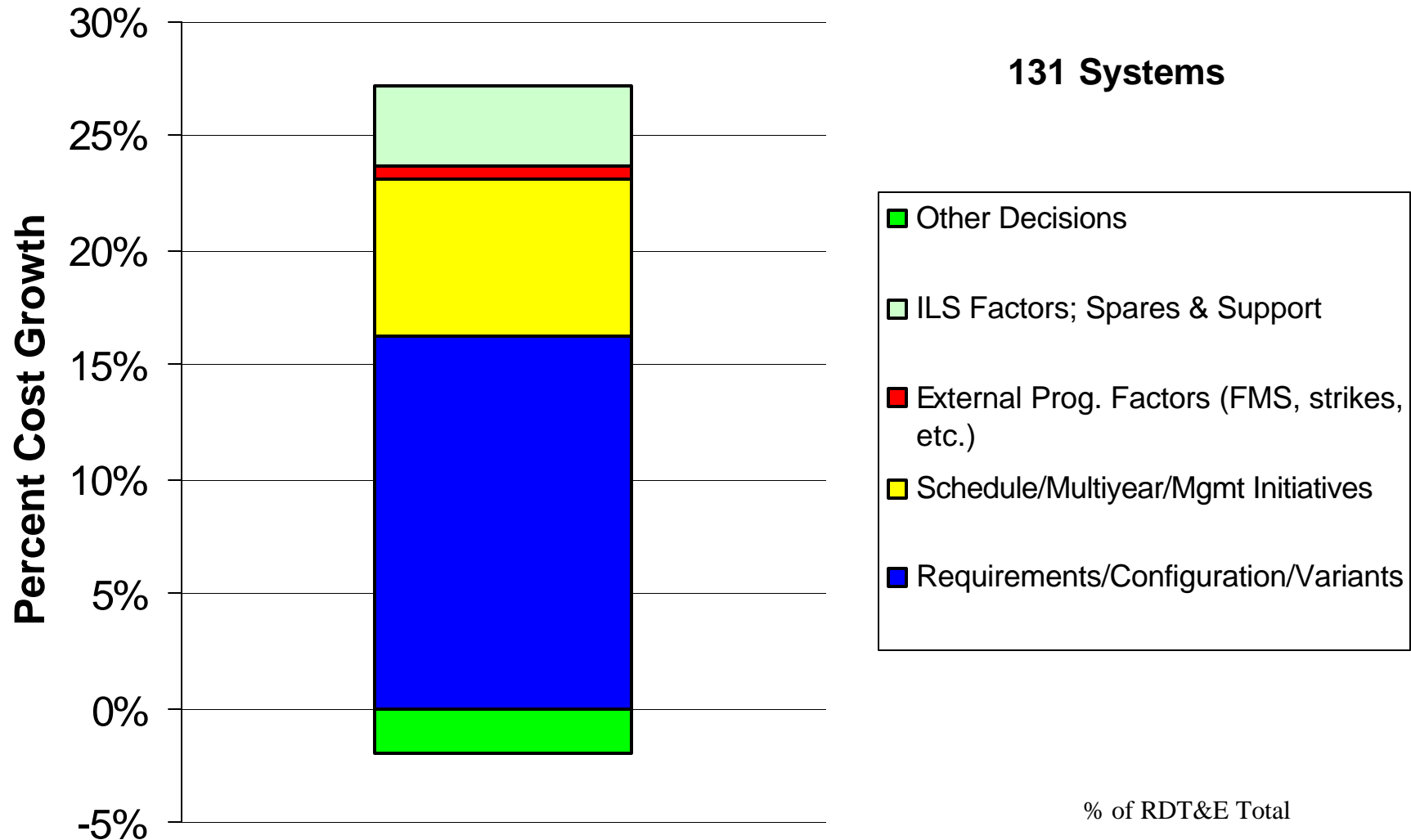
RDT&E Mistakes

Under estimating engineering effort is major source of error

137 Systems

Percent Cost Growth (y-axis: -5%, 0%, 5%, 10%, 15%, 20%, 25%, 30%, 35%)

Legend:
- Other Mistakes
- ILS Factors; Spares & Support
- Schedule Slips/Management Factors
- Engineering/Test/Development
- Production Assumptions & Estimation

% of RDT&E Total
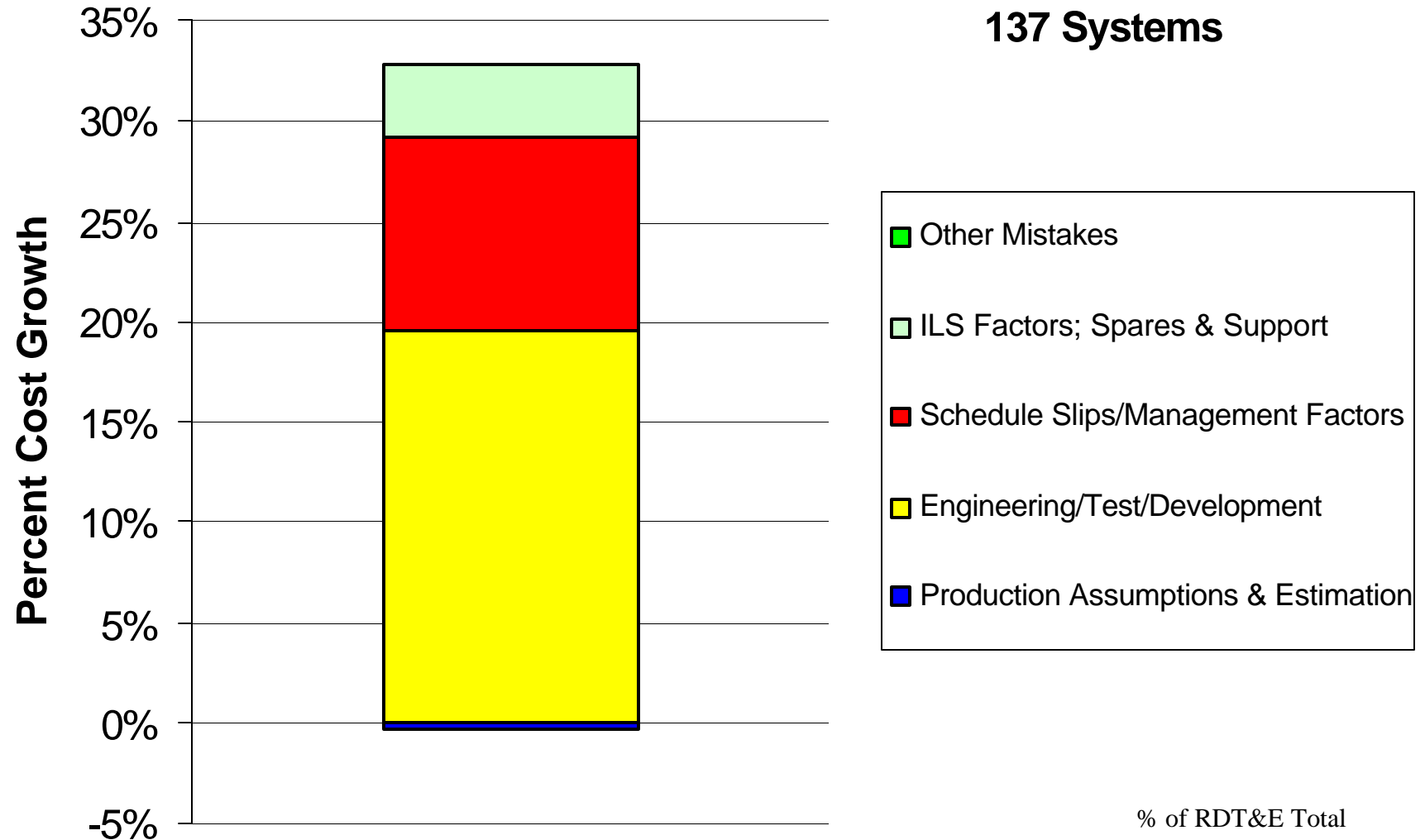
Procurement Mistakes & Decisions
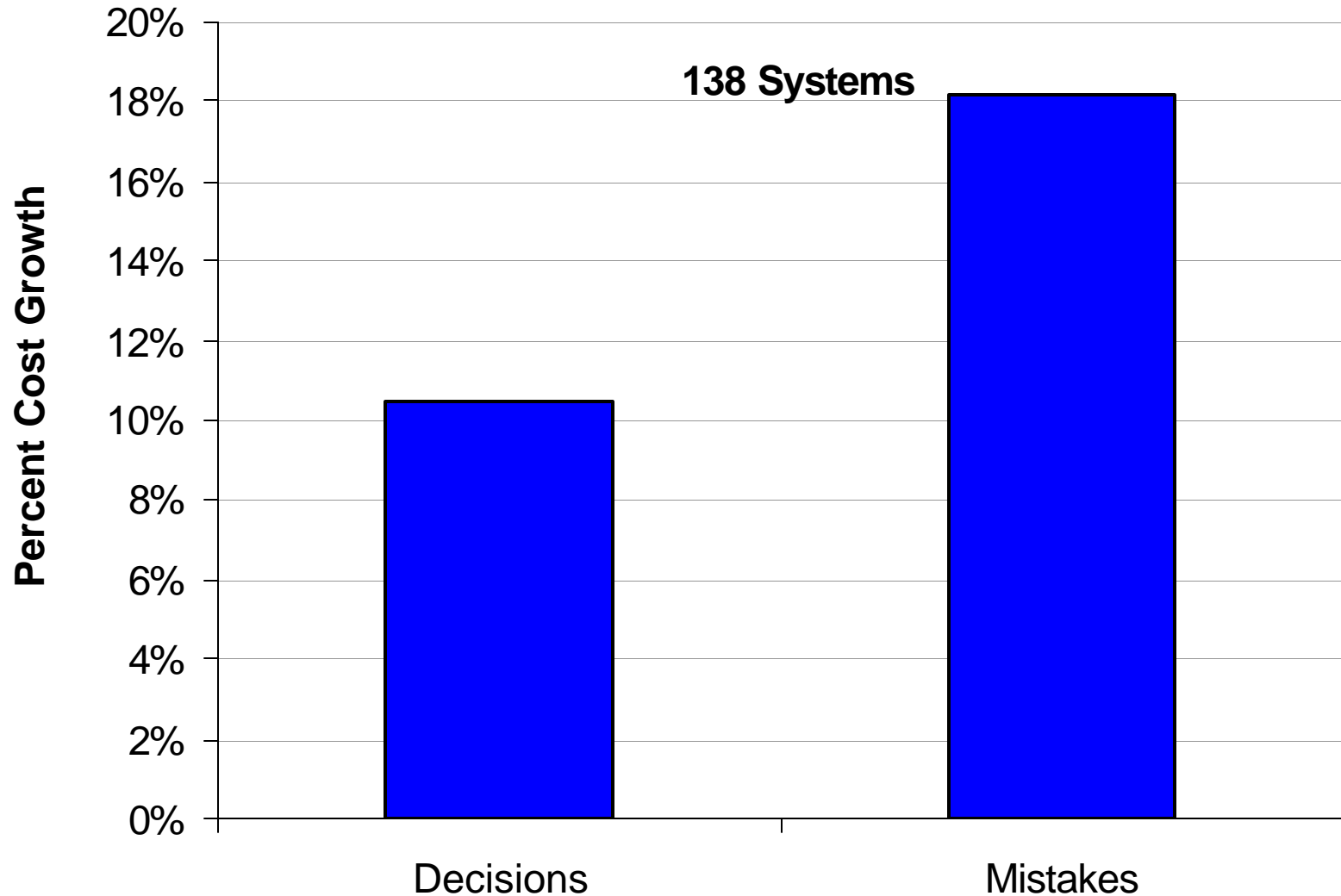
Procurement Mistakes

Major source of error is too optimistic learning curve for production assumptions

138 Systems

Percent Cost Growth

- 25%
- 20%
- 15%
- 10%
- 5%
- 0%
- -5%

☐ Other Mistakes

☐ ILS Factors; Spares & Support

☐ Schedule Slips/Management Factors

☐ Engineering/Test/Development

☐ Production Assumptions & Estimation

% of Procurement Total
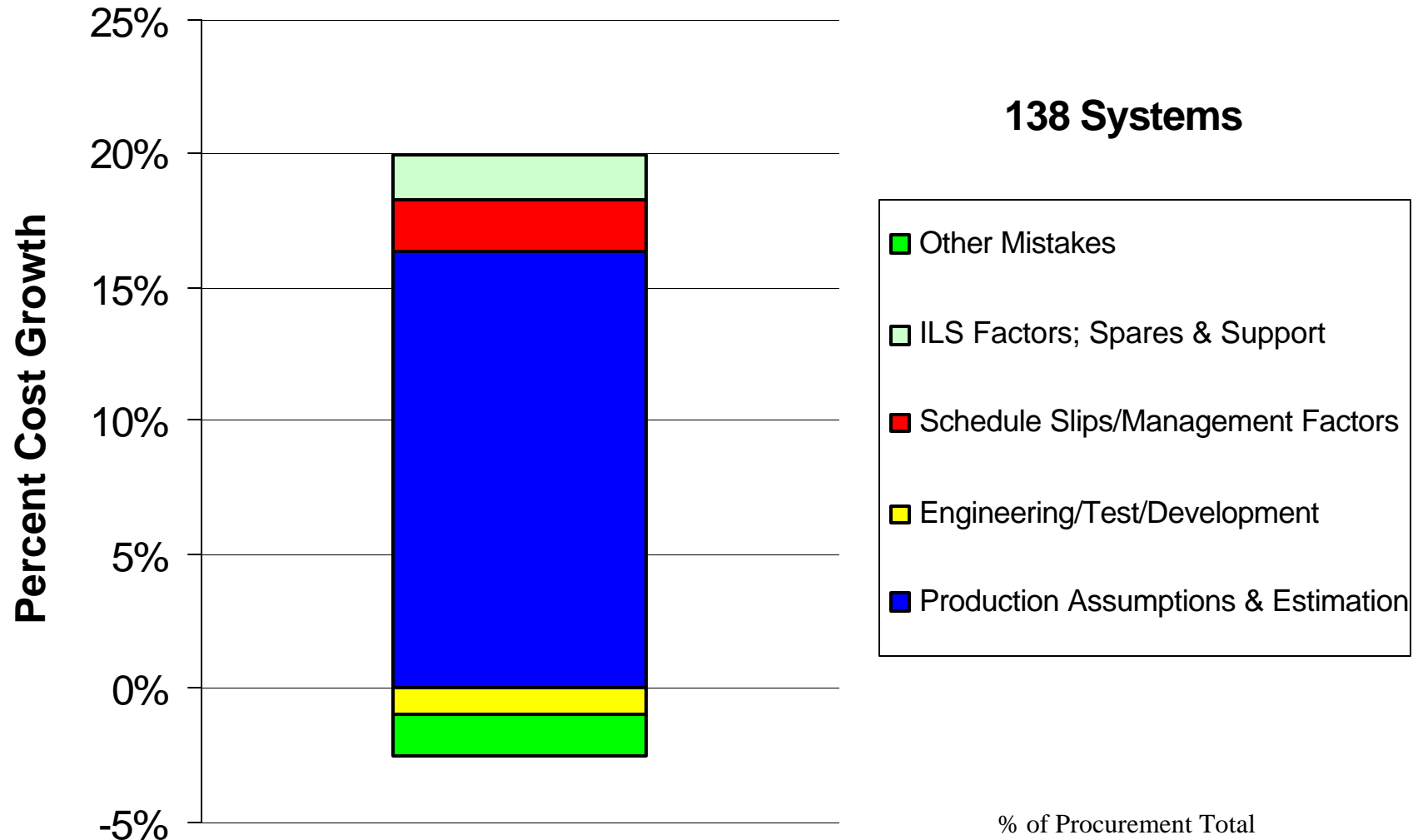
Procurement Decisions

Schedule and requirements changes cost

138 Systems

Percent Cost Growth (y-axis: 0% to 14%)

Legend:
- Other Decisions (green)
- ILS Factors; Spares & Support (light green)
- External Prog. Factors (FMS, strikes, etc.) (red)
- Schedule/Multiyear/Mgmt Initiatives (yellow)
- Requirements/Configuration/Variants (blue)

% of Procurement Total
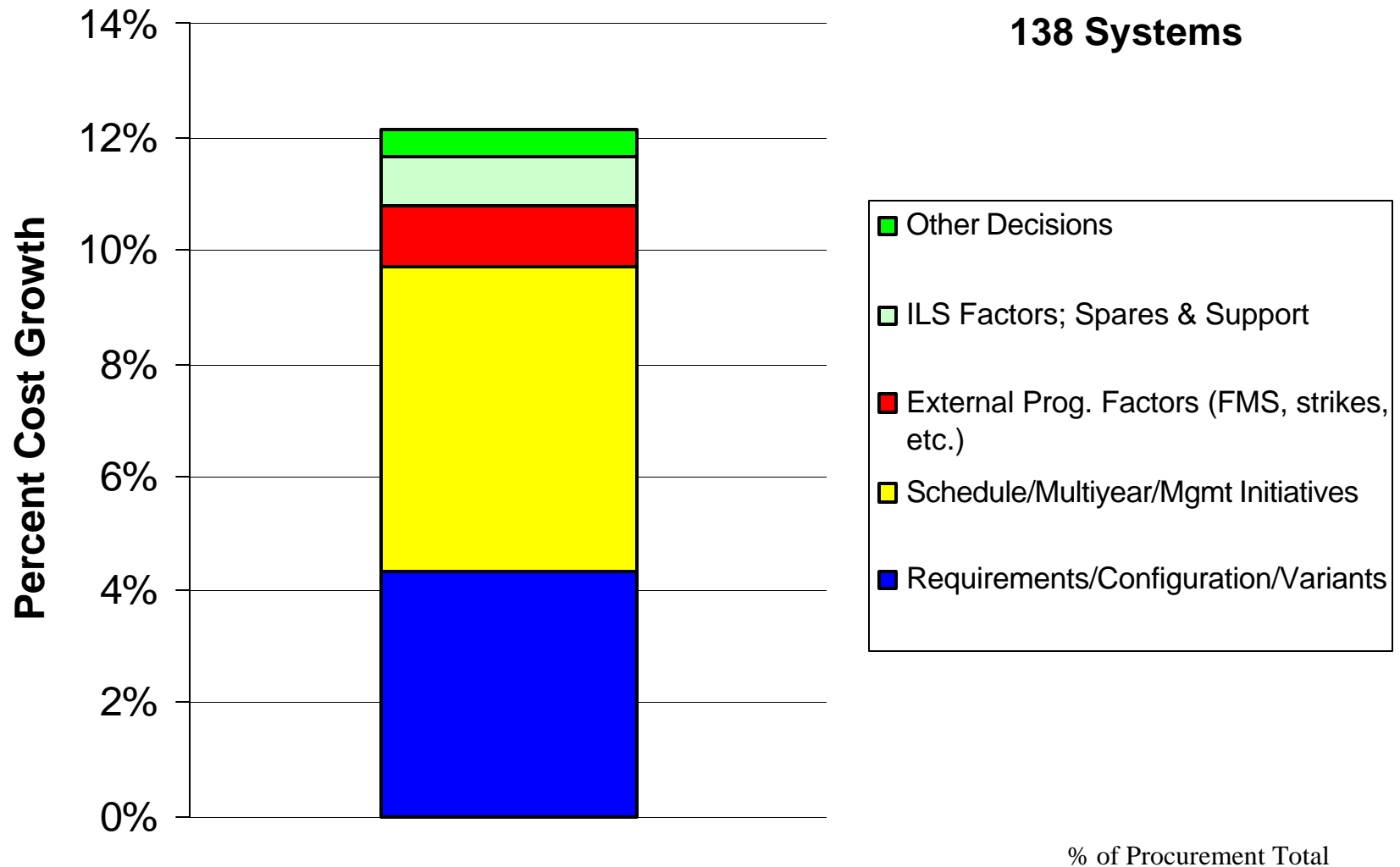
Procurement Mistakes
Right Tail

Percent Cost Growth

35 Systems

- Other Mistakes
- ILS Factors; Spares & Support
- Schedule Slips/Management Factors
- Engineering/Test/Development
- Production Assumptions & Estimation
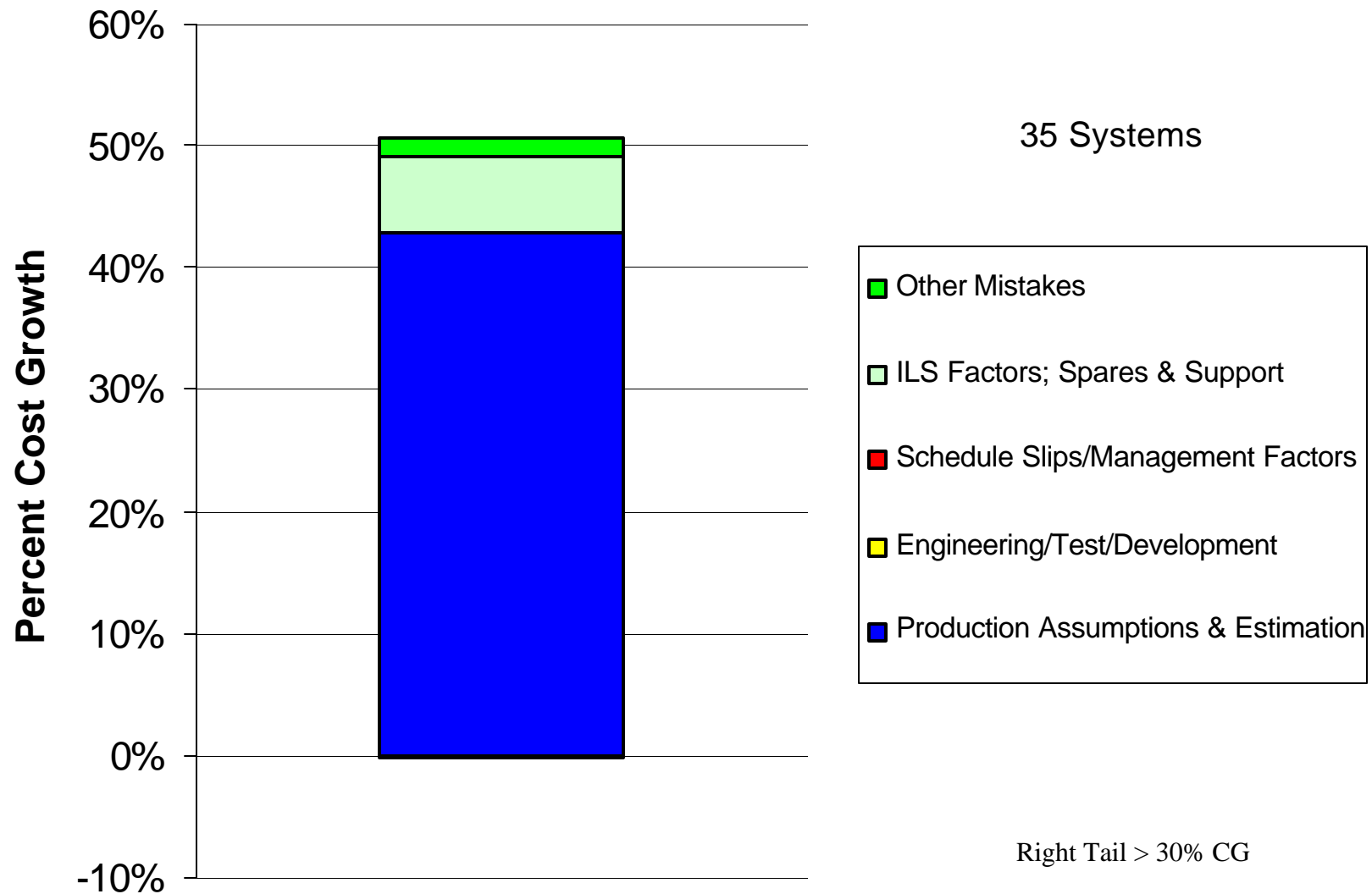
Right Tail > 30% CG

Procurement Decisions
Right Tail

Percent Cost Growth (y-axis, 50% to -10%)

17 Systems

Right Tail > 30% CG

Legend:
- Other Decisions
- ILS Factors; Spares & Support
- External Prog. Factors (FMS, strikes, etc.)
- Schedule/Multiyear/Mgmt Initiatives
- Requirements/Configuration/Variants
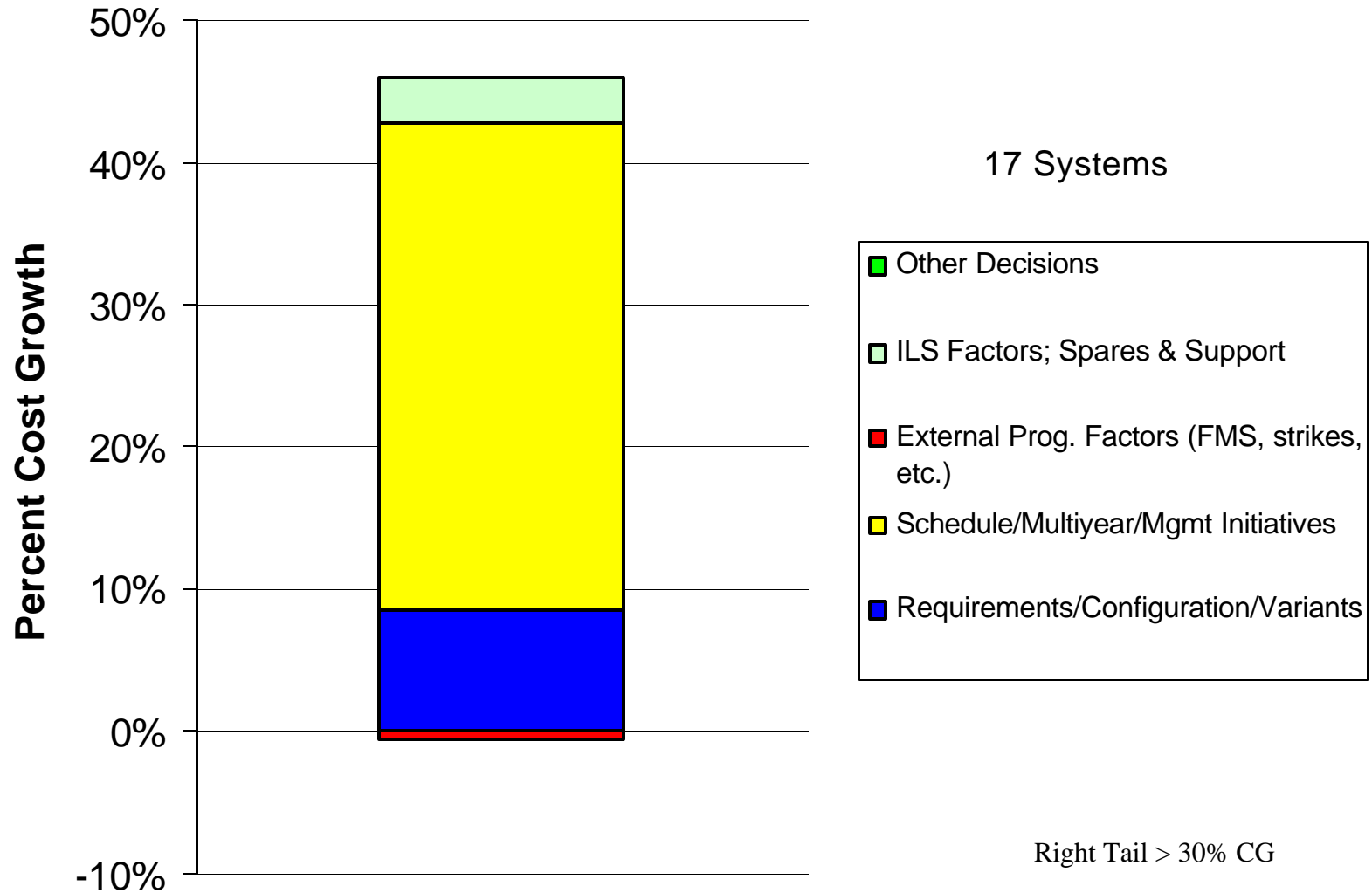
Procurement Mistakes
Left Tail

Percent Cost Growth (y-axis, 5% to -25%)

18 Systems

Legend:
- Other Mistakes
- ILS Factors; Spares & Support
- Schedule Slips/Management Factors
- Engineering/Test/Development
- Production Assumptions & Estimation

Left Tail < -10% CG
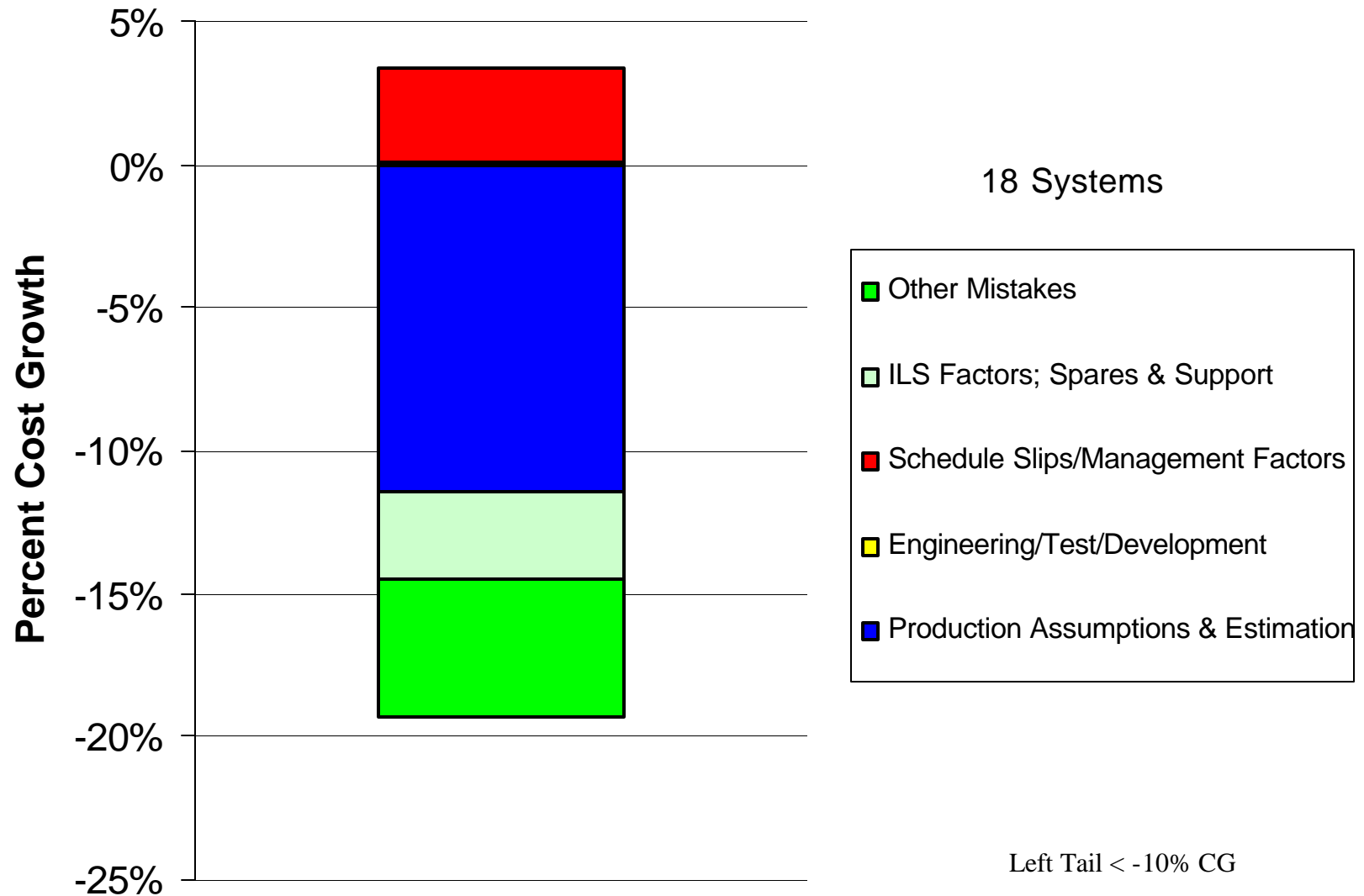
Procurement Decisions
Left Tail

14 Systems

Legend:
- Other Decisions
- ILS Factors; Spares & Support
- External Prog. Factors (FMS, strikes, etc.)
- Schedule/Multiyear/Mgmt Initiatives
- Requirements/Configuration/Variants

Y-axis: Percent Cost Growth (8% to -14%)

Left Tail < -10% CG
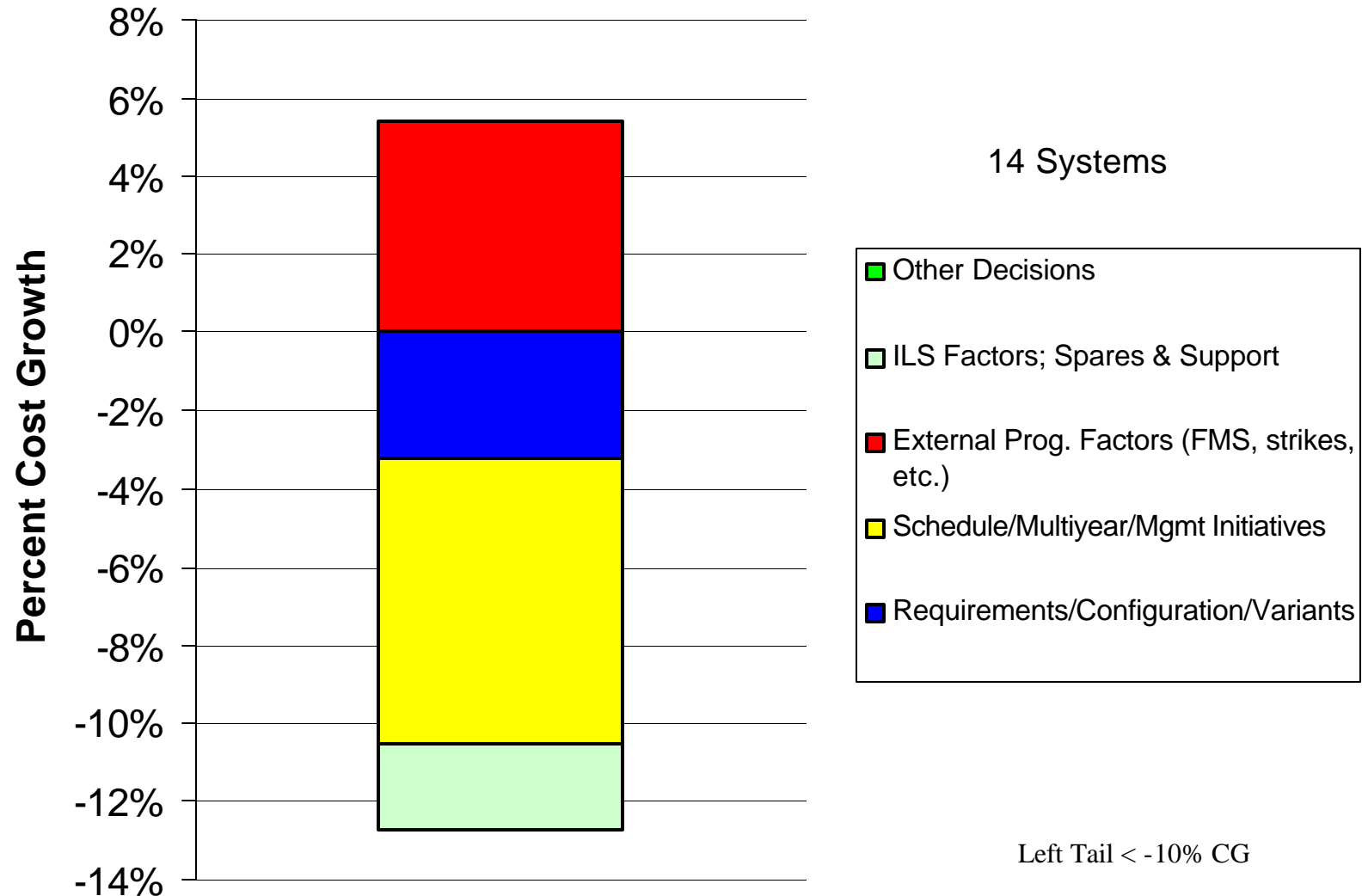
Mistakes/Decisions Summary

	Average Total CG = 32%									
	Mistakes = 20%					Decisions = 13%				
	MCEP	MCEDE	MILS	MSSMF	MOTHER	DRCV	DSMMI	DILS	DEPF	DOTHER
All	12%	6%	2%	2%	-1%	6%	6%	1%	-	-
R. Tail	42%	15%	7%	2%	2%	19%	41%	3%	-	-
L. Tail	-18%	-	-	3%	-6%	-2%	-13%	-2%	-	-

	Average RDT&E CG = 45%									
	Mistakes = 25%					Decisions = 21%				
	MCEP	MCEDE	MILS	MSSMF	MOTHER	DRCV	DSMMI	DILS	DEPF	DOTHER
All	-	20%	4%	10%	-	16%	7%	3%	1%	-2%
R. Tail	-	16%	1%	4%	1%	9%	11%	1%	1%	-
L. Tail	-	-2%	-	-	1%	-2%	-6%	-	-	-

RDT&E accounts for 18% of the total resources

	Average Procurement CG = 29%									
	Mistakes = 18%					Decisions = 10%				
	MCEP	MCEDE	MILS	MSSMF	MOTHER	DRCV	DSMMI	DILS	DEPF	DOTHER
All	16%	-1%	2%	2%	-2%	4%	5%	1%	1%	-
R. Tail	43%	-	6%	-	1%	9%	34%	3%	-	-
L. Tail	-11%	-	3%	3%	-5%	-3%	-7%	-2%	5%	-

When Is Total CG Realized?
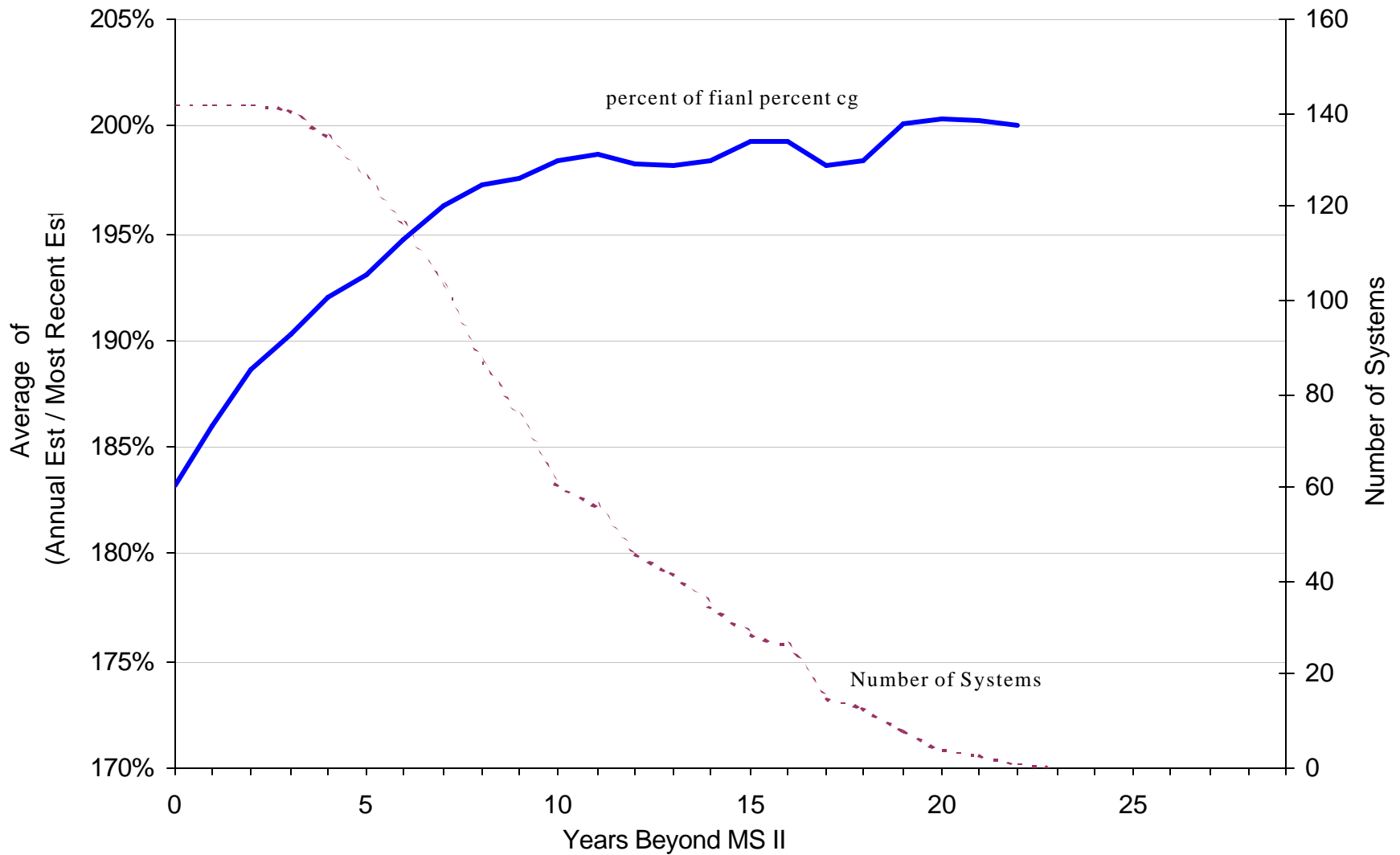
When is Procurement CG Realized?
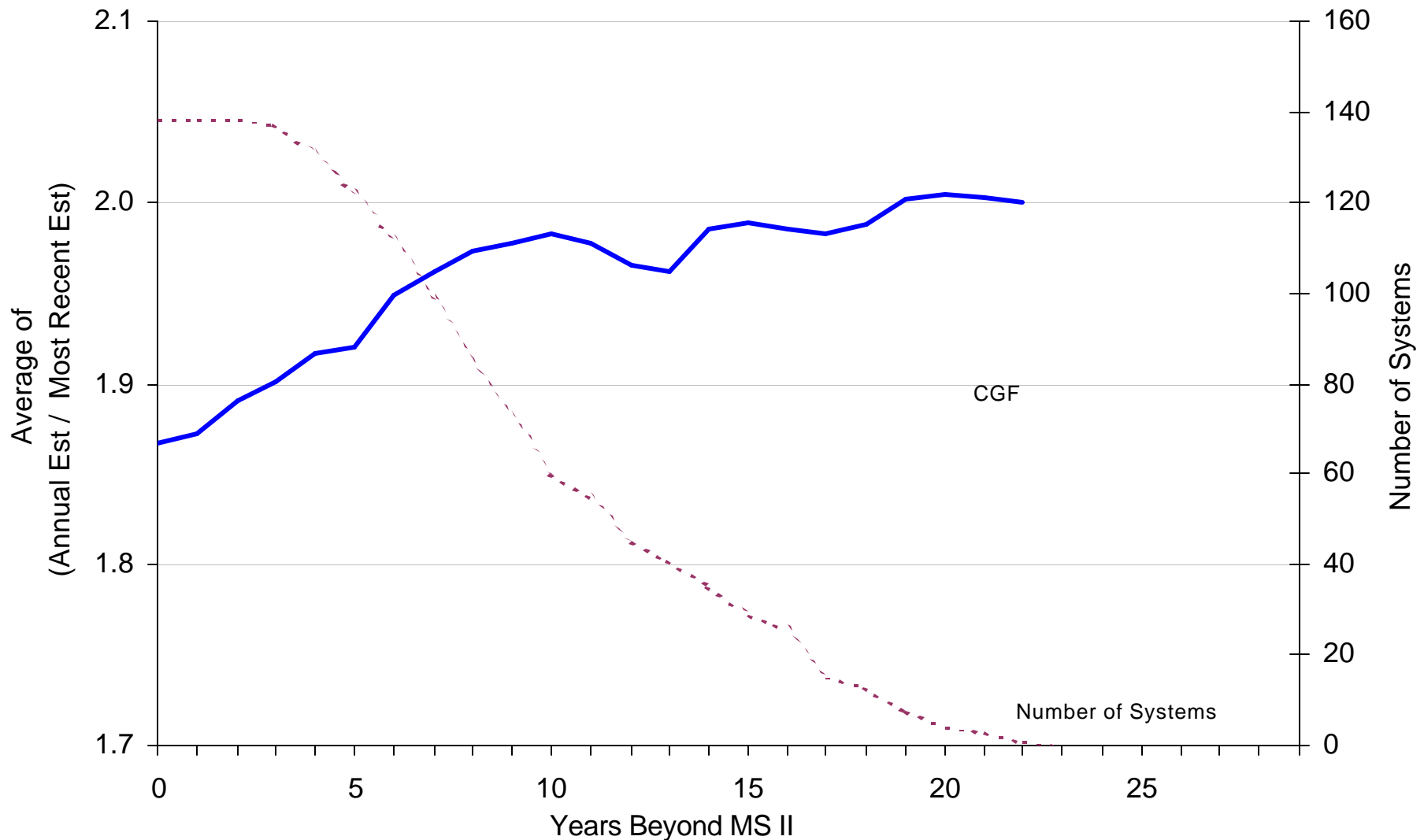
When is RDT&E CG Realized?
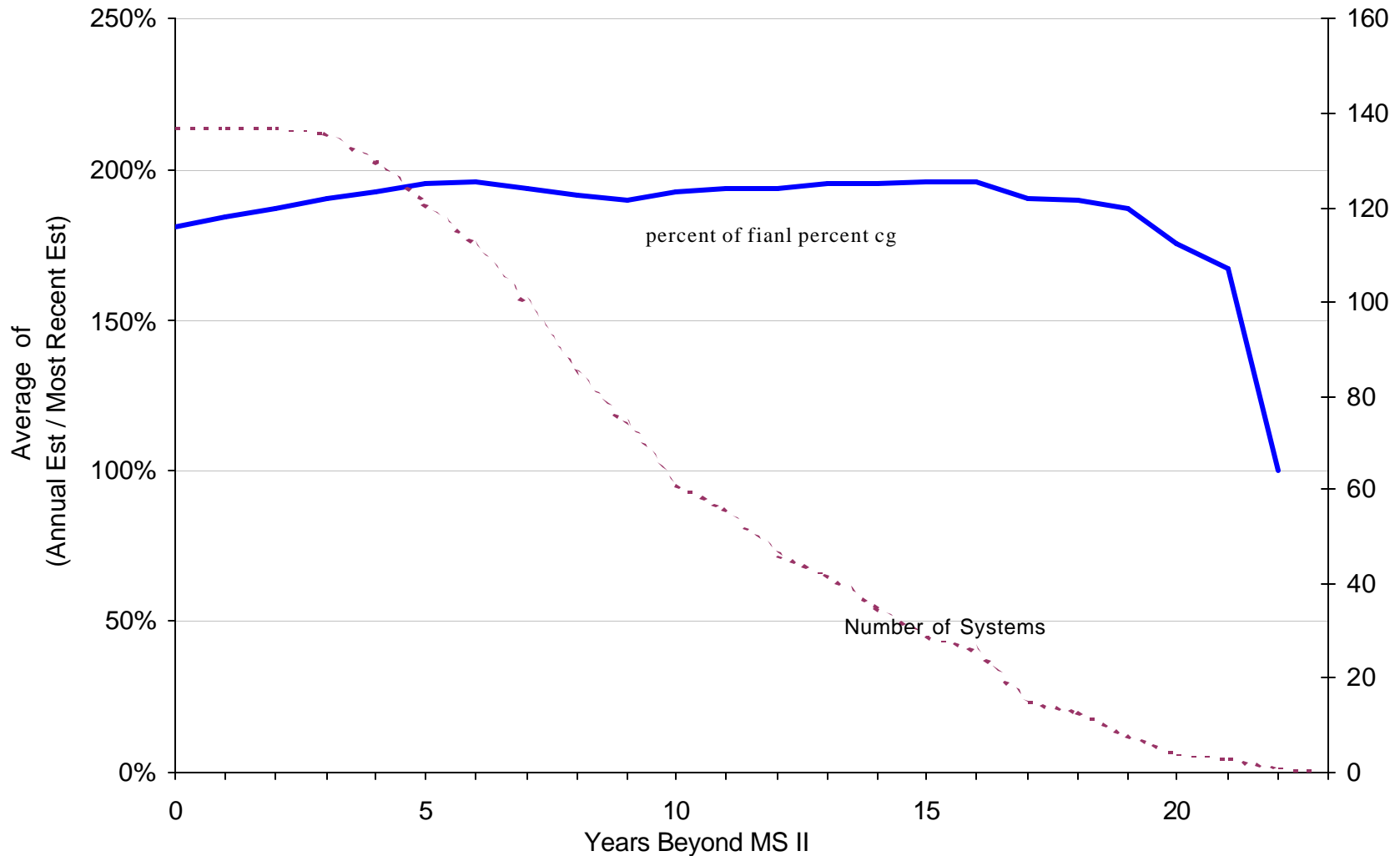
Results Conclusions

- Cost growth appears to have a correlation with commodity
- Cost estimating assumptions account for majority of mistakes cost growth
    - Poor definition, poor estimates, nose under the tent pressures, unrealistic optimism
- Under estimating engineering effort is major source of RDT&E growth
- Nearly half of perceived cost growth is content change (i.e. decisions)
- Procurement CG is primarily due to optimistic learning curves
- Majority of systems do not have significant growth
- Higher cost systems appear to have less growth

Causes

- Poor cost data
- Poor techniques or wrong metrics
- Technical assumptions
- Camel's nose under the tent (budget strategy)
- Contractor churn (profit)
- Wants vs. needs (requirements)
- Cost to budget
- Weak management (can't say no)
- Schedule changes
- Unnecessary products, rabbit trails

Website

- View and download raw SAR data and adjusted SAR variances
- View and download summary charts
- Create, view, and download charts of user selected programs
- Password protected
  - User account required

- Not yet available, pending policy approval

File   Edit   View   Favorites   Tools   Help

← Back ▾ → ▾ ⊗ ⁂ ⌂ | ◉ Search ⁂ Favorites ⁂ History | ⬛▾ ⬛ ⬛ ▾ ⬛ ◯

Address ⬛ http://yangj/mdcg/   ▾ | ⬔ Go | Links »

Welcome to the PA&E Cost Growth web site

MDAP Cost Growth

[Home]

[Program Charts]

[Chart Matrix]

Introduction   This site publishes the Cost Analysis Improvement Group (CAIG) Cost Growth (CG) study for Major Defense Acquisition Programs (MDAPs). The purpose of this study is to quantify the magnitude of MDAP cost growth and classify its sources, identifying trends and relationships as appropriate. The CAIG sponsors this site under the direction of Dr. David McNicol. This site provides access to CG source data, summary data, and analysis charts.

Overview   Cost growth is defined as any cost variance from a baseline position not attributable to inflation or quantity changes. Quantity changes are limited to the effects of learning curve caused by quantity changes. The study was conducted on MDAPs with more than three years of cost data past Milestone (MS) II. MS II is the base year for all results. All cost are shown in constant year 2000 dollars and are categorized into either "mistakes" or "decisions".

Inflation Normalization   For this study all cost are converted to constant year 2000 dollars using DoD deflators for appropriation type (RDT&E, Procurement, ...) and commodity class (Ship, aircraft, ...) using the following equation:

$$FY00 \$ = FY\$/deflator$$

Quantity Normalization   For this study we normalized the data to account for the effects of learning curve with quantity variation. As the quantity increases we would expect the unit cost to decrease. Similarly, we would expect unit cost to increase with a decrease in quantity. This study normalizes quantity changes with the following equation:

$$NV = V \left[\frac{(Q_0 + Q_{rd})^{(b+1)} - Q_{rd}^{(b+1)}}{(Q_c + Q_{rd})^{(b+1)} - Q_{rd}^{(b+1)}} \right]$$

where,

V = unadjusted variance

NV = quantity adjusted variance

Q_0 = baseline procurement quantity

Q_{rd} = RDT&E quantity

Q_c = current procurement quantity

b = learning curve constant

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⬛Start | ⬛ ⬛ ⬛ | ⬛DoD... 29°:Arlin... ⬛Inbo... ⬛Dolla... ⬛Com... ⬛CG -... ⬛Win... ⬛Stati... ⬛MD... | ⬛⬛⬛⬛⬛⬛⬛⬛⬛⬛⬛⬛29° 12:27 PM

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← Back ▾ | → ▾ | ⊗ | ⟳ | ⌂ | 🔍 Search | ⭐ Favorites | 🕘 History | 🖨 ▾ | 🖨 | W ▾ | 📄 | 💬

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Program Charts

MDAP Cost Growth

Home

Program Charts

Chart Matrix

◉ Commodity   ○ Service   [All   ▾]   [Search]

De-select the MDAPs you aren't interested in, and click [Go] to view data.

All ☑	MDAP Name *Summary Chart*	PNO	Service	Commodity	SubCommodity	Latest SAR
	[Sort] [- ▾]	[- ▾]	[- ▾]	[- ▾]	[- ▾]	[- ▾]
☑	A-10 Thunderbolt	503	Air Force	Aircraft	Tactical	1982
☑	A-6E/F Intruder	504	Navy	Aircraft	Tactical	1988
☑	ADDS EPLRS (Enhanced Pst Location Rpt Sys)	5	Army	C4I	Command and Control	1994
☑	AEGIS MK-7	6	Navy	C4I	Command and Control	1979
☑	AFATDS (Adv Field Artilleray Tact Data Sys)	7	Army	C4I	Command and Control	1998
☑	AGM-114 Hellfire	509	Army	Missile	ATG	1993
☑	AGM-114K Hellfire Longbow	528	Army	Missile	ATG	2001
☑	AGM-131A SRAM II (Short Range Msl)	562	Air Force	Missile	ATG	1991
☑	AGM-65D Maverick IR	8	Air Force	Missile	ATG	1992
☑	AGM-84A Harpoon	508	Navy	Missile	ATG	1991
☑	AGM-86B ALCM	14	Air Force	Missile	Cruise	1985
☑	AGM-88 HARM USAF	506	Air Force	Missile	ATG	1986
☑	AGM-88 HARM USN	507	Navy	Missile	ATG	1994
☑	AH-64 Apache	9	Army	Aircraft	Helicopter	1992
☑	AH-64D Apache Airframe	527	Army	Aircraft	Helicopter	2001
☑	AH-64D Apache FCR	526	Army	Aircraft	System	2001

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🏁 Start | 📷 🜁 🔵 | 🔍 DoD... | 29°:Arlin... | 📩 Inbo... | 📊 Dolla... | 📊 Com... | ✉ CG -... | 📁 Win... | 📊 Stati... | 🔵 MD... | 📄 Micr... | 🔊❤🜂⟐🔢◀🔌🔺🌐🕐29° 12:28 PM

System	A-10 Thunderbolt		RDTE PCG	PROC PCG	MilCon PCG	Total PCG
Most Recent SAR Year	1982	**MISTAKES**	14.9%	8.8%	0.0%	9.9%
Baseline Year	1973	Cost Estimating (Production)	0.0%	7.4%		6.1%
		Cost Estimating (Develop./Engrg)	14.7%	0.0%		2.5%
		ILS Factors, Spares & Support	2.0%	10.3%		8.9%
Current Estimate	9,813.3	Schedule Slips/Management Factors	1.0%	2.1%		1.9%
Current Est. Qty. Adusted to Baseline	9,507.9	Escalation Requirements	-4.3%	-6.3%		-6.0%
Baseline Estimate	7,405.2	Other Mistakes	1.5%	-4.7%		-3.6%
Adjusted Total Variance	2,102.7					
		DECISIONS	3.8%	21.6%	0.0%	18.5%
Adjusted Percent Cost Growth (PCG)	28.4%	Requirements/Configuration/Variants	1.5%	4.3%		3.8%
		Schedule/Multiyear/Mngt. Initiatives	2.4%	17.6%		15.0%
		ILS Factors, Spares & Support	0.0%	-0.3%		-0.2%
		External Prog. Factors (FMS, strikes, etc.)				
		Other Decisions				

SAR Pubctn Year	Appropriation	Explanation	SAR Cat.	M_D Cat.	QTY Adj Var
1975	PROC	Program Stretchout	Schedule	dsmmi	1148.9
1974	PROC	Addition of simulators	Support	mils	357.3
1975	PROC	Adjustment (December 1974 and March 1975 SARs are internally inconsistent)	Other	mother	-272.5
1974	PROC	Additional avionics	Engineering	mcep	266.5
1979	PROC	Adjustment for prior year escalation.	Estimating	mescl	-225.7
1981	PROC	Increased Cost due to lower Production rate	Schedule	mssmf	184.7
1979	PROC	Additional ground support equipment, simulator, other training equipment and data.	Support	mils	151.4
1976	PROC	Add Avionics	Engineering	mcep	147.3
1977	PROC	Add inertial navigation system.	Engineering	drcv	135.1
1975	RDTE	Follow-on Development effort	Engineering	mcede	126.7
1977	PROC	Estimating baseline adjustments.	Estimating	mcep	121.3
1982	PROC	Adjustment for prior year escalation.	Estimating	mescl	-112.6
1981	PROC	Reestimate of initial spares	Support	mils	106.2
1980	PROC	Delete Outyear Simulators	Support	dils	-104.0
1974	PROC	Transfer of four RDTE aircraft to procurement account.	Quantity	drcv	79.1
Total			*****	*****	2109.8

Comment

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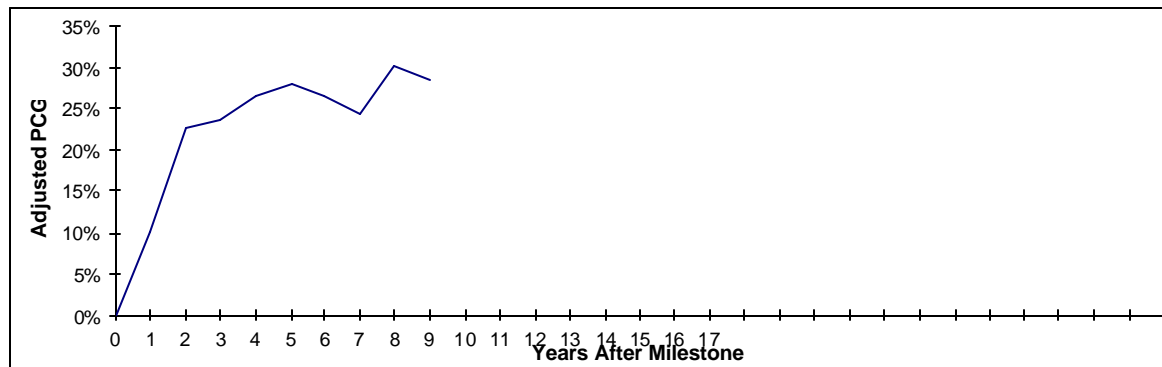
MDAP Cost Growth

- Home
- Program Charts
- Chart Matrix

Chart Matrix

MDAP Cost Growth Chart Matrix
Click on the ● to see the chart.

Title	Type	RDT&E Mistakes	RDT&E Decisions	RDT&E M&D	RDT&E M&D Summed	Proc Mistakes	Proc Decisions	Proc M&D	Proc M&D Summed	RDT&E & Proc Separate Mistakes	Sep Decisions	Sep M&D	Sep M&D Summed	RDT&E & Proc Summed Mistakes	Sum Decisions	Sum M&D	Sum M&D Summed
%CG vs. Commodity Class	**Multi-Bar**																
Army				●	●			●	●			●	●	●	●	●	●
Navy		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Air Force		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Joint		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
All (Summmed)		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
All (Individually)		●	●	●	●	●	●	●	●	●	●		●	●	●	●	●
# Systems vs. %CG ranges	**Histogram**	●	●		●	●	●		●					●	●		●
Army		●	●		●	●	●		●					●	●		●
Navy		●	●		●	●	●		●					●	●		●
Air Force		●	●		●	●	●		●					●	●		●
Joint		●	●		●	●	●		●					●	●		
All (Summmed)		●	●		●	●	●		●					●	●		
All (Individually)		●	●		●	●	●		●					●	●		
% Procurement CG vs. % RDT&E CG	**Correlation**																
Aircraft																	
Electronic																	
Helicopter																	
Missile																	

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MDAP Cost Growth

Home

Program Charts

Chart Matrix

Program Downloads and Charts

You chose the following program(s)....

| A-10 Thunderbolt |
| AGM-131A SRAM II (Short Range Msl) |
| AGM-65D Maverick IR |
| AGM-86B ALCM |

Option #1: Select New Program(s)

Click here to return to the program search screen.

Option #2: Summary Download

Select download type and press "download":

⦿ Cost Growth Factors   [download..]
◯ Program Base Data

Option #3: View Program(s) In A Chart

Select a chart from the matrix below. Charts contain data only for selected programs.

Click on the ● to see the chart.

Title	Type	RDT&E Mistakes	RDT&E Decisions	RDT&E M&D	RDT&E M&D Summed	Proc Mistakes	Proc Decisions	Proc M&D	Proc M&D Summed	RDT&E & Proc Separate Mistakes	RDT&E & Proc Separate Decisions	RDT&E & Proc Separate M&D	RDT&E & Proc Separate M&D Summed	RDT&E & Proc Summed Mistakes	RDT&E & Proc Summed Decisions	RDT&E & Proc Summed M&D	RDT&E & Proc Summed M&D Summed
%CG vs. Commodity Class	Multi-Bar	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
# Systems vs. %CG ranges	Histogram	●	●		●	●	●		●					●	●		●
%CG ranges vs. # Systems	Histogram																
%CG vs. Growth Category	Bar	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
%CG vs. Growth Sub Categories	Bar	●	●		●	●	●		●					●	●		●

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Data Access

- Access policy not established
  - 2-4 months
- Anticipate it will be available to those working in the cost community
  - Those doing their own research
  - Combining results with other studies
  - Access will probably be provided on a case by case basis

- Don't want to see our data in the newspaper with our name on it, "OSD PA&E says …"

Future

- Website access (2-4 months)
- Ability to select different milestones (~4-months)
- Ability to select different base year (~4-months)
- Documentation (~6 months)
  - This is all we have at the moment
- 2002 SARs and beyond (~6 months)
- Add SAR source data links
- Production rate change research

Contact Information

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